THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

Volume 15 MARCH, 1936 Number 3

Forty years ago Edward Orton, Jr., began the manufacture of pyrometric cones in America. This work is continued by the Edward Orton, Jr., Ceramic Research Foundation, established in 1932 by provision of Dr. Orton's will. In 1894, a decade after his graduation from Ohio State University, Dr. Orton organized at his Alma Mater the world's first collegiate Department of Ceramic Engineering. In 1898 he organized the American Ceramic Society. He was an outstanding pioneer American Ceramist. For an outline of the fields to which Dr. Orton contributed during his life see page 74.

PROGRAM

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AMERICAN CERAMIC SOCIETY

MARCH 29 TO APRIL 4, 1936

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The Porcelain Enamel and Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Seaboard Feldspar Co.
The Vitro Mfg. Co.

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Ferro Enamel Corp.
Norton Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Spinks Clay Co., H. C.

Flint
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Porcelain Enamel and Mfg. Co.
The Roessler & Hasslacher Chemical Co.

Flint Pebbles
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Consolidated Feldspar Corp.
Ferro Enamel Corp.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.

Floors (Non-Slip)
Norton Co.

French Flint
Consolidated Feldspar Corp.
Paper Makers Importing Co.

Frit
Allied Engineering Co.
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Fuel Oil Systems and Control, Stokers
Bethlehem Steel Co.
Simplex Eng. Co.

Furnaces
Allied Engineering Co.
Carborundum Co. (*Carboradiant*)
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Ferro Enamel Corp.
The Hommel Co., O., Inc.
Porcelain Enomel & Mfg. Co.
Simplex Engineering Co.

Glass Bending Ovens, Glass Decorating Machines
Simplex Eng. Co.

Glass Equipment
Hartford-Empire Co.
Lancaster Iron Works, Inc.

Glass Melting Pots (Open and Covered)
Pittsburgh Plate Glass Co.

Glass Melting Tanks and Furnaces
Pittsburgh Plate Glass Co.
Simplex Eng. Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Ferro Enamel Corp.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Porcelain Enamel and Mfg. Co.
The Roessler & Hasslacher Chemical Co.

Glazes and Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld & Co., B. F.
Ferro Enamel Corp.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel & Mfg. Co.
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Glaze Spar
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.

Goggles
Willson Products, Inc.

Gold
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Granulators
Lancaster Iron Works, Inc.

Grinding Wheels
Carborundum Co. (*Carborundum and Aloxite*)
Chicago Vitreous Enamel Product Co.
Norton Co. (*Alundum-Crystolon*)

Hearths
Carborundum Co. (*Carbofrax* heat treating)
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co. (*Crystolon*)

Hearths (Fused Al_2O_3, SiC)
Electro Refractories & Alloys Corp.

Hearths (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Norton Co.

Hose (Air and Fluid)
The DeVilbiss Co.

Iron (Enameling)
American Rolling Mill Co.
Bethlehem Steel Co.

Iron Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Kaolin
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Edgar Brothers Co.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
United Clay Mines Corp.

Kellogg AA Refractories
Electro Refractories & Alloys Corp.

Kilns, China (Decorating)
Allied Engineering Co.
Denver Fire Clay Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
Simplex Engineering Co.

Kiln Furniture (Silicon Carbide, Semi-Silicon Carbide)
Electro Refractories & Alloys Corp.

Kryolith
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Laboratory Ware
Norton Co.

Lehr Tile (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Electro Refractories & Alloys Corp.

Lehrs
Simplex Engineering Co.

Lehrs (Electric or Fuel Heated)
Simplex Eng. Co.

Lehr Loaders
Simplex Engineering Co.

Linings (Furnace Refractory, Block Refractory Plate, Brick and Tile)
Carborundum Co.
Chicago Vitreous Enamel Product Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Norton Co.
Pittsburgh Plate Glass Co.
The Vitro Mfg. Co.

Magnesia (Fused)
Electro Refractories & Alloys Corp.

Magnesia (Sintered, Calcined)
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
Norton Co.
The Porcelain Enamel and Mfg. Co.

Magnesite
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.

Manganese
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Manganese (Oxide)
Ceramic Color & Chemical Mfg. Co.
Corhart Refractories Co.
The Roessler & Hasslacher Chemical Co.

Masks (Breathing)
The DeVilbiss Co.
Willson Products, Inc.

Metals (Porcelain Enameling)
American Rolling Mill Co.
Bethlehem Steel Co.

Microscopes (Polarizing)
Bausch & Lomb Optical Co.

Minerals
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Mixers (Batch)
Lancaster Iron Works, Inc.

Mold Sanders
Lancaster Iron Works, Inc.

Muffles (Furnace)
Allied Engineering Co.
Carborundum Co. (*Carbofrax*)
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Ferro Enamel Corp.
Norton Co.
Pittsburgh Plate Glass Co.
Simplex Engineering Co.

Muffles (Laboratory)
Electro Refractories & Alloys Corp.

Mullite (Refractories)
Electro Refractories & Alloys Corp.

Muriatic Acid
Denver Fire Clay Co.
The Hommel Co., O., Inc.

Nitrates (Cobalt, Sodium)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Non-Gro Refractories
Electro Refractories & Alloys Corp.

Norbide (Norton Boron Carbide)
Norton Co.

Olivine
The Roessler & Hasslacher Chemical Co.

Opacifiers
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Metal & Thermit Corp.
Porcelain Enamel & Mfg. Co.
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Oxides
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld & Co., B. F.
Ferro Enamel Corp.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Metal & Thermit Corp.
Porcelain Enamel & Mfg. Co.
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Pins
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
The O. Hommel Co.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Potters Supply Co.

Polariscopes
Bausch & Lomb Optical Co.
Simplex Engineering Co.

Porcelain Enameling Service (Practical)
American Rolling Mill Co.
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Porcelain Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel & Mfg. Co.
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Potash (Carbonate)
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
The Roessler & Hasslacher Chemical Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

Producer Gas Plants
Simplex Eng. Co.

Pug Mills
Lancaster Iron Works, Inc.

Pyrophyllite
The Seaboard Feldspar Co.

Pyrometer Tubes
Carborundum Co.
Electro Refractories & Alloys Corp.

Pyrometer Tubes (Refractory and Hard Porcelain)
Denver Fire Clay Co.
McDanel Refractory Porcelain Co.
Norton Co.

Pyrometric Cones
The Edward Orton, Jr., Ceramic Foundation

Raw Material Handling Equipment
Simplex Engineering Co.
Lancaster Iron Works, Inc.

Refractometers
Bausch & Lomb Optical Co.

Refractories
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.
Pittsburgh Plate Glass Co.

Refractory Materials
Carborundum Co.
Chicago Vitreous Enamel Product Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.
Pittsburgh Plate Glass Co.
Titanium Alloy Mfg. Co.

Represses (Automatic)
Lancaster Iron Works, Inc.

Respirators
Chicago Vitreous Enamel Product Co.
The DeVilbiss Co.
The O. Hommel Co.
Willson Products, Inc.

Rutile
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Saggers
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.
Potters Supply Co.

Salt Cake
American Potash & Chemical Co.
The O. Hommel Co.

Sandblast Helmets
Willson Products, Inc.

Sand Grinder and Sifters
Lancaster Iron Works, Inc.

Saponin
The O. Hommel Co.

Selenite of Sodium
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Selenium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Sheets (Enameling Iron)
American Rolling Mill Co.
Bethlehem Steel Co.

Silica (Fused)
Electro Refractories & Alloys Corp.
The Hommel Co., O., Inc.

Silicate of Soda
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
The Hommel Co., O., Inc.

Silicon Carbide
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Silicon Carbide Firesand
Carborundum Co.

Sillimanite Refractories
Electro Refractories & Alloys Corp.

Sillimanite (Synthetic)
Pittsburgh Plate Glass Co.

Slabs (Furnace)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Pittsburgh Plate Glass Co.

Smelters
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.

Soda Ash
American Potash and Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
The Hommel Co., O., Inc.
Pittsburgh Plate Glass Co.
The Roessler & Hasslacher Chemical Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

Sodium Antimonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Sodium Fluoride
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Sodium Silica Fluoride
Ceramic Color & Chemical Mfg. Co.
The O. Hommel Co.

Soot Blowers
Simplex Engineering Co.

Special Machines
Simplex Engineering Co.

Spar
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.

Spray Booths
The DeVilbiss Co.

Spraying Equipment
The DeVilbiss Co.

Spurs
Potters Supply Co.

Stacks
Lancaster Iron Works, Inc.

Steel Plate Construction
Bethlehem Steel Co.
Lancaster Iron Works, Inc.

Stilts
Potters Supply Co.

Sulfuric Acid
Denver Fire Clay Co.
The Hommel Co., O., Inc.

Talc
Ceramic Color & Chemical Mfg. Co.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.

Tanks
Simplex Engineering Co.

Tank Blocks
Corhart Refractories Co.
Pittsburgh Plate Glass Co.

Tanks (Pickle)
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
The O. Hommel Co.

Tanks for Raw Material Steel or Concrete
Bethlehem Steel Co.
Lancaster Iron Works, Inc.

Tile (Floor)
Norton Co.

Tile (Muffle)
Carborundum Co
Electro Refractories & Alloys Corp.
Norton Co.

Tile (Refractory)
Carborundum Co. (*Carbofrax*)
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co
Electro Refractories & Alloys Corp.
Norton Co.
Pittsburgh Plate Glass Co.

Tile (Wall)
Denver Fire Clay Co.
Ferro Enamel Corp.

Tin Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Titanium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Titanium Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Trucks
Lancaster Iron Works, Inc.

Tubes (Insulating)
Carborundum Co.
McDanel Refractory Porcelain Co.
Norton Co.

Tubes (Pyrometer)
Carborundum Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
McDanel Refractory Porcelain Co.
Norton Co.
Pittsburgh Plate Glass Co.

Water Softening Plants
Simplex Eng. Co.

Wet Enamel
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Whiting
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.

Winding Drums
Lancaster Iron Works, Inc.

Zinc Oxide
Ceramic Color & Chemical Mfg. Co.
The O. Hommel Co.
The Vitro Mfg. Co.

Zirconia
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

THE AMERICAN CERAMIC SOCIETY

Incorporated in 1899

TO PROMOTE CERAMIC ARTS, SCIENCE, AND TECHNOLOGY

IS A CONTINUATION EDUCATIONAL "COOPERATIVE"

IT PUBLISHES REPORTS OF ORIGINAL RESEARCHES AND ABSTRACTS WORLD-WIDE CERAMIC LITERATURE

Monthly Publications of The American Ceramic Society

The Journal of the American Ceramic Society } issued on
Ceramic Abstracts } the 1st

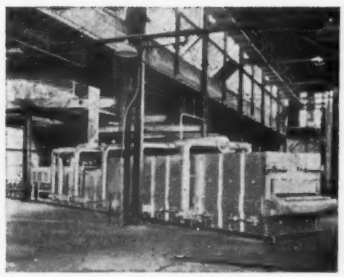
The Bulletin of the American Ceramic Society—issued on the 15th

YOUR PARTICIPATION IN THIS "COÖPERATIVE" IS SOLICITED

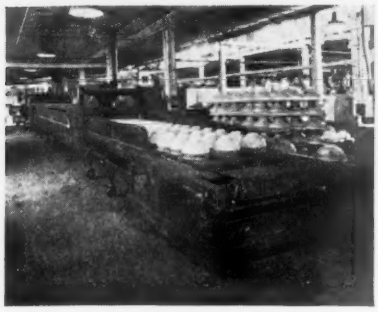
THE AMERICAN CERAMIC SOCIETY
2525 NORTH HIGH STREET
COLUMBUS, OHIO

6′ x 400′ Continuous Sheet Glass Lehr

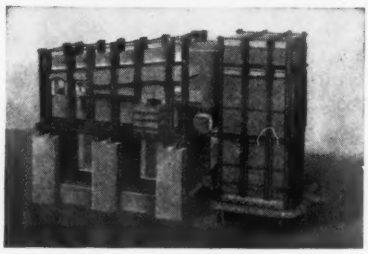
Modern Glass Plant Built by Amco



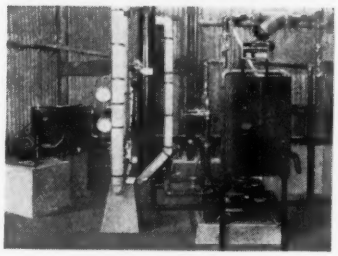
Amco Bulb Lehr—Speed 30 FPM



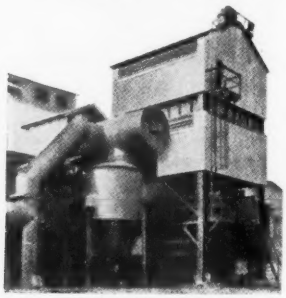
Amco Decorating Lehr



The Amco Recuperative Tank



Amco Fuel Oil System



Amco Unit Gas Producer Plant

Regardless of what you need

Whether it be a mould oven or a completely equipped glass plant—AMCO can build it better.

We build

Lehrs ranging in size from one foot to ten feet in width and from forty to four hundred feet in length.

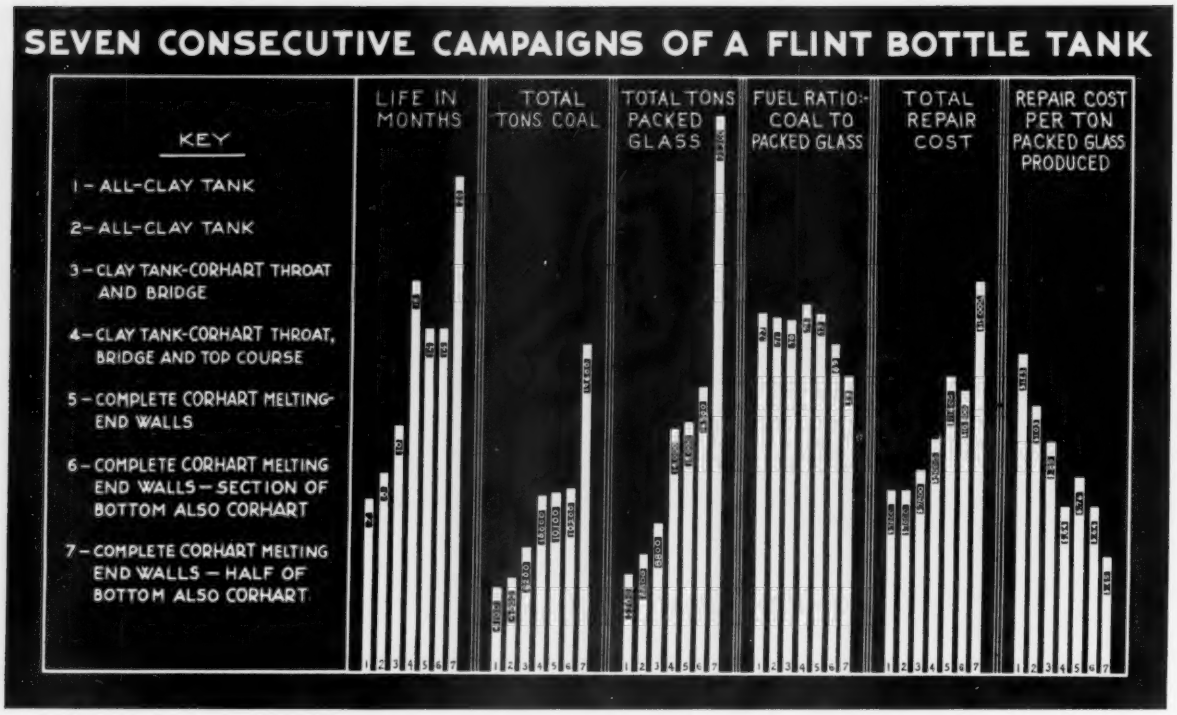
Tanks from one to one hundred fifty tons daily capacity.

Recuperative or regenerative pot furnaces of any size.

Gas producers, fuel oil systems, Batch handling, storage and mixing equipment. In fact—if it is glass plant equipment, AMCO builds it.

ANSLER-MORTON COMPANY

FULTON BLD. PITTSBURGH


SEVEN CONSECUTIVE CAMPAIGNS OF A FLINT BOTTLE TANK
KEY
1 – ALL-CLAY TANK
2 – ALL-CLAY TANK
3 – CLAY TANK-CORHART THROAT AND BRIDGE
4 – CLAY TANK-CORHART THROAT, BRIDGE AND TOP COURSE
5 – COMPLETE CORHART MELTING-END WALLS
6 – COMPLETE CORHART MELTING END WALLS – SECTION OF BOTTOM ALSO CORHART
7 – COMPLETE CORHART MELTING END WALLS – HALF OF BOTTOM ALSO CORHART
LIFE IN MONTHS
TOTAL TONS COAL
TOTAL TONS PACKED GLASS
FUEL RATIO:- COAL TO PACKED GLASS
TOTAL REPAIR COST
REPAIR COST PER TON PACKED GLASS PRODUCED

7 FIRES AT ONE GLANCE

THE chart above gives, at one glance, the entire cost-data of a momentous case-history, which was eight long years in the making—the history of *one tank* during seven consecutive fires, starting on all-clay construction and ending with the extensive use of Corhart Electrocast.

Life. Please note that, in the gradual change from clay to Corhart, life has been increased from 7 months to 20 months—and this in spite of the fact that daily pull has been almost doubled.

Packed Glass. Please note that *packed* glass has risen from 5,700 tons to 32,300 tons per fire—a net *increase* of 466%.

Repair Cost per Ton of Glass. Here is the crux of the whole situation. By greatly increasing life and output, even at a considerable extra repair cost, this manufacturer has reduced his repair-cost-per-ton from the former figure of $1.25 to a record low of 45 cents per ton—a reduction of 63½% and a saving of 78 cents for every ton of glass *packed*.

In studying this chart, please bear in mind that the actual figures of cost are not so important as the *percentage of change*. Every furnace is different, and it may very possibly be true that your furnaces are producing better records than those shown above. The point to consider is that, over a long period of time, these costs have been progressively lowered, and that Corhart Electrocast has been one of the prime factors in their progress.

Corhart Refractories Co., Incorporated, 16th and Lee Sts., Louisville, Ky. *In Europe:* L'Electro Refractaire, Paris. *In Japan:* Asahi Glass Co., Tokio.

QUALITY ECONOMY ENDURANCE

CORHART ELECTROCAST REFRACTORIES

THE BULLETIN
OF THE AMERICAN CERAMIC SOCIETY

A Monthly Publication Devoted to Proceedings of the Society and Promotion of Coöperative Research of Technical, Scientific, and Art Questions

VOLUME 15 MARCH, 1936 NUMBER 3

PROGRAM OUTLINE

THIRTY-EIGHTH ANNUAL MEETING, AMERICAN CERAMIC SOCIETY

March 29 to April 4, 1936, Columbus, Ohio

Headquarters for Meetings: Deshler-Wallick Hotel and the Neil House

On Sunday and Monday (March 29 and 30), Registration will be held at the Deshler-Wallick Hotel.

On Tuesday and Wednesday (March 31 and April 1), Registration will be held both at the Neil House and the Deshler-Wallick Hotel.

Five-dollar ($5.00) Registration Fee

This fee covers admission, without further charge, to all technical meetings and to all social and entertainment events, including the following:

(1) Sunday Night, 8:30 P.M.: President's Reception and Glee Club Concert: Ball Room–Deshler-Wallick Hotel

(2) Monday Night, 6:30 P.M.: "Pep Supper," Entertainment, and Group Singing led by professionals: Grand and Junior Ball Rooms–Neil House

(3) Wednesday Night, 9:30 P.M.: Dance and Floor Show: Grand and Junior Ball Rooms–Neil House

NOTICE

One-third return railroad fare at the 3.6 cents per mile rate has been arranged.

Be sure to secure your Certificate when purchasing your going ticket.

Members of the Society and guests are requested to leave their *Railroad Certificates* at the Registration Desk for validation. Each *Certificate* must be signed legibly to insure rapid and accurate handling.

(4) All entertainments arranged especially for the ladies.

Saturday, March 28

3:00 P.M.

Board of Trustees Meeting: Wallick Suite–Deshler-Wallick Hotel

Sunday, March 29

10:30 A.M.

Committee Meetings: Parlor A and Room 216–Deshler-Wallick Hotel

12:30 P.M.

Board of Trustees and Committees, Joint Luncheon: Parlors B and C–Deshler-Wallick Hotel

3:00 P.M.

Association of Ceramic Educators: Room 216–Deshler-Wallick Hotel

5:00–7:00 P.M.

Board of Trustees and Committees, Joint Dinner Meeting: Parlors A, B, and C–Deshler-Wallick Hotel

7:30 P.M.

Committee on Ceramic Education: Room 216–Deshler-Wallick Hotel

8:30 P.M.

President's Reception and Music by Capital University Glee Club Quartet and String Ensemble: Ball Room–Deshler-Wallick Hotel

Every Day

Enamel Testing Equipment Exhibit: Room 217–Deshler-Wallick Hotel

General exhibits of materials and equipment–mezzanine lobby of The Neil House

Editorial and Publication Headquarters: Room 22–Deshler-Wallick Hotel (all week); Mezzanine Floor–Neil House (Tuesday and Wednesday)

Student Headquarters: Room 21–Deshler-Wallick Hotel

Monday, March 30

10:00 A.M.–12:00 M.

General Session: Ball Room–Deshler-Wallick Hotel

(*a*) President's Address: J. M. McKinley

(*b*) Illustrated Lecture: "Is Stained Glass a Lost Art?" (See *Bull. Amer. Ceram. Soc.*, 15 [1] 20–21; [2] 62 (1936).)

By Lawrence Saint, Huntingdon Valley, Pa.

(*c*) Illustrated Lecture: "Creative Expression through Ceramic Art" (See this issue, p. 96.)

By Mabel C. Brady, Haaren High School, New York, N. Y.

12:00 M.–2:00 P.M.

Committee C-8, American Society for Testing Materials: Room 216–Deshler-Wallick Hotel

2:00 P.M.–5:00 P.M.

Symposium on Ceramic Ware Firing (auspices of the Materials and Equipment Division): Ball Room–Deshler-Wallick Hotel

3:30 P.M.–5:00 P.M.

Fellows of the American Ceramic Society, Business Meeting: Rooms A, B, and C–Deshler-Wallick Hotel

6:30 P.M.–9:00 P.M.

"Get-Acquainted Pep Supper," College Follies, and Ruckus Songs led by professional singers: Ball Room–Neil House

$2.00 per plate for those not registered

9:00 P.M.–11:00 P.M.

Student Reception by Trustees and Officers of the Society: Ball Room–Deshler-Wallick Hotel

The Ohio State University Student Branch will be hosts to all visiting students at a Buffet Supper at 9:30 P.M.

Tuesday, March 31

9:30 A.M.–12:30 P.M. and 2:00 P.M.–5 P.M.

Division Meetings

Art Division: Blue Room–Neil House

Enamel Division: Rooms A, B, and C (Exhibit of Testing Equipment, Room 217)–Deshler-Wallick Hotel

Glass Division: Ball Room–Neil House

Materials and Equipment Division: Room 216–Deshler-Wallick Hotel

Refractories Division: Ball Room–Deshler-Wallick Hotel

Structural Clay Products and Terra Cotta Divisions (joint sessions): Red Room–Neil House

White Wares Division: Junior Ball Room–Neil House

5:45 P.M.

Ceramic School Reunions (specific announcements for schools will be found at the Registration Desk)

8:30 P.M.

(1) Edward Orton, Junior, Memorial Fellow Lecture: "Contribution of Mineralogy to Ceramic Technology and Ceramic Research"

By William J. McCaughey, Dept. of Mineralogy, Ohio State University, Columbus, Ohio

(2) Presentation of Charles Fergus Binns Medal

9:45 P.M.

(1) Induction of Society Officers and Fellows

(2) Concert by Ohio State University Glee Club Quartet and String Ensemble

Wednesday, April 1

9:30 A.M. to 5:30 P.M.

Division Meetings as on Tuesday

12:00 M.–1:45 P.M.

Refractories Division Luncheon; Lecture and Motion Picture by R. C. Benner, The Carborundum Company: Ball Room–Deshler-Wallick Hotel

5:00 P.M.

Keramos Meeting: Room H–Deshler-Wallick Hotel

6:45 P.M.

(1) Keramos Banquet: Hall of Mirrors–Deshler-Wallick Hotel

(2) Publications Committee and Abstracters Dinner Meeting: Colonial Room–Neil House

9:30 P.M.

Dance (Floor Show at 11:00 P.M.): Ball Room–Neil House

$1.00 per person not registered

Thursday, April 3

9:30 A.M.–12:00 M.

Enamel Division: Rooms A, B, and C–Deshler-Wallick Hotel

9:30 A.M.–12:00 M.

Brick Engineers' Council of the Telegram Brick Manufacturer's Association: Neil House–Red Room

2:00 P.M.

Structural Clay Products Research Foundation: Red Room–Neil House

Visits in City of Columbus

(1) American Ceramic Society Executive Headquarters, 2525 North High Street
(2) Ohio State University: (*a*) Ceramic Engineering Laboratories, Lord Hall
(*b*) Ceramic Art Laboratories, Hayes Hall
(*c*) Engineering Experiment Station
(3) The Edward Orton, Jr., Ceramic Research Foundation
(4) Battelle Memorial Institute

Friday, April 3

Plant Visits

Golf tournament at Columbus Country Club in the afternoon (weather permitting)

Saturday, April 4

Plant Visits

LADIES ENTERTAINMENT

March 29 to April 1, 1936

Mrs. Ellsworth P. Ogden, Chairman

Headquarters: Wallick Addition Spanish Lounge
Deshler-Wallick Hotel

Exhibits on Neil House Mezzanine Floor

For Ladies' Prizes see p. 104

Sunday, March 29

8:30 P.M.

President's Reception and Music by Capital University Glee Club Quartet and String Ensemble: Ball Room–Deshler-Wallick Hotel

Monday, March 30

10:00 A.M.–12:00 M.

General Session: Ball Room–Deshler-Wallick Hotel

(*a*) President's Address: J. M. McKinley
(*b*) "Is Stained Glass a Lost Art?" illustrated (see *Bull. Amer. Ceram. Soc.*, **15** [1] 20–21; [2] 62 (1936))
By Lawrence Saint, Huntingdon Valley, Pa.
(*c*) "Creative Expression through Ceramic Art"; illustrated (see this issue, p. 96)
By Mabel C. Brady, Haaren High School, New York, N. Y.

2:00 P.M.

Columbus Gallery of Fine Arts: Lecture on Ceramic Art and Demonstration on Potter's Wheel. See this issue, p. 99.
By Arthur E. Baggs, Dept. of Ceramic Art, Ohio State University

4:00 P.M.

Tea at the Gallery of Fine Arts. Mrs. Edward Orton, Jr., *Chairman*

There will be an exhibition of Ceramic Art at the Gallery

6:30 P.M.

"Get-Acquainted Pep Supper," College Follies, and Ruckus. Songs led by professional singers: Ball Room–Neil House

$2.00 for lady not registered

Tuesday, March 31, 1936

11:00 A.M.

Illustrated Lecture on "American Chinaware" By Arthur S. Watts, Dept. of Ceramic Engineering, Ohio State Univ.: Mezzanine Floor–Neil House

1:00 P.M.

Luncheon at the Faculty Club, Ohio State University

Puppet demonstration and play by Miss Marjorie Batchelder, Dept. of Fine Arts, Ohio State Univ.

$1.00 for lady not registered

4:00 P.M.

Tea at Executive Offices, American Ceramic Society. *Hostess*, Mrs. Ross C. Purdy; *Assisting Hostesses*, Mrs. J. M. McKinley and Mrs. F. C. Flint

8:30 P.M.

Edward Orton, Jr., Memorial Fellow Lecture by William J. McCaughey. Presentation of Charles Fergus Binns Medal: Ball Room–Deshler-Wallick Hotel

9:45 P.M.

(1) Induction of Society Officers and Fellows
(2) Concert by Ohio State University Glee Club Quartet and String Ensemble

Wednesday, April 1, 1936

1:00 P.M.

Visit to Tucker Orchid Farm (or substitute program)

9:30 P.M.

Dance (Floor Show at 11:00 P.M.): Ball Room–Neil House

$1.00 for lady not registered.

PLANT TRIPS PROGRAM

Thursday, April 2, 1936

9:00 A.M.

Morning and Afternoon

(1) Executive headquarters of the American Ceramic Society, 2525 North High Street

It is the desire of the officers of the Society that every member visit the Headquarters. A valuable library on ceramics and related subjects and an extensive museum of historical and contemporary ceramic products are to be seen.

(2) The Battelle Memorial Institute, 505 King Avenue

Very complete laboratories for research work in metallurgy, ceramics, fuel, and allied fields are housed in a stately and impressive building.

(3) The Edward Orton, Jr., Ceramic Research Foundation, 1445 Summit Street

Research work is being conducted at this laboratory, with particular emphasis on pyrometric cones. The manufacture of cones will be observed here.

(4) The Ohio State University

(*a*) The Engineering Experiment Station Building in which the ceramic research laboratories are located.

(*b*) Lord Hall which houses the Department of Ceramic Engineering.

(*c*) Hayes Hall which houses the Department of Ceramic Art.

This trip will show the extensive educational and research facilities in ceramics which are located in Columbus.

NOTE: Trips are planned for both morning and afternoon, so that those attending morning meetings may have an opportunity to see these Columbus institutions in the afternoon.

Friday, April 3

9:30 A.M.

(1) The Ebco Manufacturing Co., 401 West Town Street

Manufacturers of cast-iron and steel enameled ware.

(2) The Owens-Illinois Glass Company, 711 Southwood Avenue

The Columbus plant makes milk bottles, plain and decorated.

(3) The D. L. Auld Company, East Fifth Avenue and Fifth Street

Manufacturers of enameled automobile radiator name plates, etc.

1:30 P.M.

Golf Tournament at the Columbus Country Club

All Day Out-of-Town Trips

Zanesville, Ohio

(1) The S. A. Weller Company
(2) The Roseville Pottery Company
(3) The Mosaic Tile Company

This trip will be of particular interest to the members of the White Wares and Art Divisions.

Mansfield, Ohio

(1) Westinghouse Electric & Manufacturing Company (2 plants; steel enameling)
(2) The Humphries Manufacturing Company (cast-iron enameling)

This trip will be of particular interest to members of the Enamel Division.

Committee on Plant Trips

John L. Carruthers, *Chairman*, Ohio State University, Columbus, Ohio
H. E. Simpson, Battelle Memorial Institute, Columbus, Ohio
A. L. Simison, Owens-Illinois Glass Company, Newark, Ohio
Walter Hughes, S. A. Weller Co., Zanesville, Ohio
J. O. Everhart, Ohio State Univ., Engineering Expt. Station, Columbus

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LOCAL COMMITTEES FOR THE THIRTY-EIGHTH ANNUAL MEETING

Executive Committee

George A. Bole (*Chairman*), Edward Orton, Jr., Ceramic Research Foundation, Columbus, Ohio
Clyde E. Williams, Battelle Memorial Institute, Columbus, Ohio
C. Forrest Tefft, The Claycraft Company, Columbus, Ohio
Earl Crooks, Crooksville China Company, Crooksville, Ohio
Frank Ransbottom, Robinson-Ransbottom Pottery Company, Roseville, Ohio
Arthur S. Watts, Dept. of Ceramic Engineering, Ohio State Univ., Columbus, Ohio

Committee Chairmen

Meeting Service: John D. Sullivan, Battelle Memorial Institute
General Entertainment: Ross C. Purdy, American Ceramic Society
Ladies' Entertainment: Mrs. Ellsworth P. Ogden, 1957 Chelsea Rd., Columbus, Ohio
Plant Trips: J. L. Carruthers, Dept. of Ceramic Engineering, Ohio State Univ.
Publicity: Clyde E. Williams, Battelle Memorial Institute
Exhibits: Arthur S. Watts, Ohio State University
Finances: C. Forrest Tefft, The Claycraft Co.

GENERAL SESSIONS PROGRAMS

DESHLER-WALLICK HOTEL: BALL ROOM

Monday Forenoon, March 30, 1936: 10:00 A.M.–12:00 M.

Under the Auspices of the Officers of the Art Division

1. President's Address

By J. M. McKinley: North American Refractories Co., Cleveland, Ohio

2. Is Stained Glass a Lost Art?

By Lawrence Saint: Huntingdon Valley, Pa.

3. Creative Expression through Ceramic Art

By Mabel C. Brady: Haaren High School, New York, N. Y.

CERAMIC WARE FIRING SYMPOSIUM

Under the Auspices of the Officers of the Materials and Equipment Division

DESHLER-WALLICK HOTEL: BALL ROOM

Monday Afternoon, March 30, 1936: 2:00 P.M.–5:00 P.M.

2:00–2:45 P.M.

1. The Effect of Heat Treatment on Properties of Glasses

By J. T. Littleton: Corning Glass Works, Corning, N. Y.

Data are given showing that the physical properties of glass, when held at constant temperature, are not attained immediately at this temperature but that there is a lag and that this lag depends upon the viscosity of the glass. This effect is illustrated by showing time rates of change at constant temperatures of expansion coefficient, electrical conductivity, viscosity, specific heat, and anomalous charging currents. The change in expansion coefficient is shown to be particularly important when it comes to sealing different glasses together and glasses to metals.

2:45–3:30 P.M.

2. Review of Data on Combustion in Ceramic Kilns

By W. E. Rice: Fuels Section, U. S. Bureau of Mines Expt. Station, Pittsburgh, Pa.

No new data are presented. Supposed discrepancies in previously published conclusions (see *The Bulletin*, **14** [12] 398 (1935)) are shown to be apparent and not real. The secondary air control needed to obtain long flame conditions in periodic kilns is discussed. The value of more frequent firing of alternated fire boxes is set forth, as is also the value of admitting into the "bag wall" a portion of the secondary air needed for complete combustion rather than passing all of it over the fuel bed.

3:30–3:45 P.M.

3. Gas-Fired Radiant Tubes as Applied to Atmosphere Furnaces

By H. C. Weller: Development Div., Surface Combustion Co., Toledo, Ohio

A general discussion is presented on furnace atmospheres and their influence upon the quality and finish of the ware. Muffle-type and electric-furnace atmospheres are reviewed and compared with radiant-tube fired furnaces. The combustion within the tube is explained and the relative radiant efficiency of Premix and diffusion flames discussed. Applications of radiant tubes to the ferrous and nonferrous industries are described and the requirements for their use in the enameling and pottery fields are analyzed.

3:45–4:00 P.M.

4. Draft Control as Means of Fuel Conservation in Kiln Firing

By H. R. Straight: Straight Engineering Co., Adel, Iowa

The importance of closely regulating the internal pressure of a kiln under fire is discussed from a standpoint of uniformity of heat treatment of the charge, reduction of fuel consumption, and efficiency in the use of combustible gases. An attempt is made at an analysis of the causes of low efficiency and high fuel consumption.

4:00–4:15 P.M.

5. Results Obtained in a Lenox Walking-Beam Kiln

By L. S. Briggs: Lenox, Inc., Trenton, N. J.

4:15–4:30 P.M.

6. Cooling Clayware

By J. L. Carruthers: Dept. of Ceramic Engineering, Ohio State University, Columbus, Ohio

A discussion of (1) the importance of the cooling period in a clayware firing process and (2) the various technical, operating, and economic factors involved is presented. The necessary time-temperature relationship during cooling for optimum results can be determined only by balancing the various factors in each case.

4:30–4:45 P.M.

7. Control of Coloration of Clayware in the Tunnel Kiln

By W. D. Richardson: 366 King Ave., Columbus, Ohio

In firing of some clay products, control of kiln atmosphere and the character of the gases affecting coloration is as important as control of temperature.

Fuel gases should be kept from contact with ware in the watersmoking zone to insure against scumming and sulfuring. To control the character of the gases in the firing zone, whether oxidizing or reducing, air from the cooling zone should not pass into the firing zone except through the furnaces, the quantity of air admitted to each furnace being easily regulated. Such control is positively and practically accomplished in the progressing-compart-

ment, downdraft tunnel kiln, which also can be adapted for saltglazing, the glazing compartment being operated independently during the salting.

4:45–5:00 P.M.

8. Improved Kiln Firing System

By H. C. Kleymeyer: Standard Brick & Tile Corp., Evansville, Ind.

The author discusses an improved system of firing regenerative round downdraft kilns in series by a predetermined schedule of heat raising throughout periods of watersmoking, oxidation, finishing heat, and soaking; a schedule of the proper draft and execssive air for each period is determined and also the predetermined rate of cooling the kilns to prevent damage to the ware.

5:00–5:15 P.M.

9. The Importance of the Watersmoking Period

By Marion W. Blair: 2131 South Center St., Terre Haute, Ind.

5:15–5:30 P.M.

10. The Need for Accurate Control of Firing Conditions

By Paul Teetor: Poultney, Vt.

Some typical problems encountered in the firing of ceramic ware are presented and it is shown how their successful handling depends upon accurate control of firing conditions.

THE AMERICAN CERAMIC SOCIETY TRUSTEES 1935–1936

President: J. M. McKinley, North American Refractories Co., Cleveland, Ohio
Vice-President: Francis C. Flint, Hazel-Atlas Glass Co., Zanesville, Ohio
Treasurer: H. B. Henderson, H. B. Henderson Co., New Brighton, Pa.
Secretary-Editor: Ross C. Purdy, 2525 North High St., Columbus, Ohio
Past-President: W. Keith McAfee, Universal Sanitary Mfg. Co., New Castle, Pa.
Past-President: John C. Hostetter, Corning Glass Works, Corning, N. Y.

TRUSTEES FROM THE INDUSTRIAL DIVISIONS

Art: Frederick H. Rhead, Homer Laughlin China Co., Newell, W. Va.
Enamel: W. C. Lindemann, Lindemann & Hoverson Co., Milwaukee, Wis.
Glass: J. T. Littleton, Corning Glass Works, Corning, N. Y.
Materials and Equipment: Victor V. Kelsey,* Consolidated Feldspar Corp., Trenton, N. J.
Refractories: R. B. Sosman, United States Steel Corp., Kearny, N. J.
Structural Clay Products: R. B. Keplinger,* Metropolitan Paving Brick Co., Canton, Ohio
Terra Cotta: R. L. Clare,* Federal Seaboard Terra Cotta Corp., Woodbridge, N. J.
White Wares: Perry D. Helser, General Ceramics Co., New York, N. Y.

* Term expires 1936.

OFFICERS OF THE FELLOWS FOR 1935–1936

Dean: Frank H. Riddle, Champion Spark Plug Co., Detroit, Mich.
Associate Dean: Arthur S. Watts, Dept. of Ceramic Engineering, Ohio State University, Columbus, Ohio
Secretary: George H. Brown, Dept. of Ceramic Engineering, Rutgers University, New Brunswick, N. J.

EDWARD ORTON, Jr.

October 8, 1863 to February 10, 1932

1884 Graduated from Ohio State University
1894 Organized the Department Ceramic Engineering, Ohio State University
1896 Began manufacturing pyrometric cones
1898 Organized the American Ceramic Society
1899 Appointed State Geologist
1902 Dean of College of Engineering
1913 Organized the Engineering Experiment Station, Ohio State University
1916 Coöriginator of National Defense Act
1917 Commissioned Major in the U. S. Army
1919 Awarded Distinguished Service Medal
1922 Doctor of Science, Rutgers University
1930 President of the American Ceramic Society
1931 Doctor of Laws, Alfred University

ART DIVISION PROGRAM

Chairman, L. E. BARRINGER, General Electric Company, Schenectady, N. Y.
Secretary, C. M. HARDER, New York State College of Ceramics, Alfred, N. Y.
Chairman (Industrial Design and Decoration Group), F. H. RHEAD, Homer Laughlin China Company, Newell, W. Va.
Chairman (Non-Industrial Art and Education Group), R. G. COWAN, Onondaga Pottery Company, Syracuse, N. Y.

NEIL HOUSE: BLUE ROOM

Tuesday and Wednesday, March 31–April 1, 1936: 9:30 A.M.–4:30 P.M

1. A Study of the Color Effect Obtained by the Primitive Potters of North Arizona

By George Brainerd: Ohio State Univ., Columbus, Ohio.

An effort was made to discover the method used by prehistoric Indian potters in coloring their ware. The composition of the paints used and the temperature and conditions of firing were studied.

2. Ceramic Art Exhibitions

By R. Guy Cowan: Onondaga Pottery Company, Syracuse, N. Y.

The relation of the American Ceramic Society to ceramic art exhibitions is discussed.

DISCUSSION TOPICS

3. Ceramic Instruction in Secondary Schools

By L. E. Barringer

A continuation of the discussion at the First Fall Meeting of the Art Division of the American Ceramic Society, October, 1935, Syracuse, N. Y. (See *Bull. Amer. Ceram. Soc.*, **15** [1] 1–13; this issue, pp. 116–28.

4. Low-Temperature Glazes and Bodies for the Craft Potters

5. A Ceramic Art Publication: The Bulletin versus Some Other Medium

MATERIALS AND EQUIPMENT DIVISION PROGRAM

Chairman, C. H. PEDDRICK, JR., United Feldspar Corp., New York, N. Y.
Secretary, J. E. EAGLE, The Vitro Manufacturing Co., Pittsburgh, Pa.
Program Chairman, H. F. KLEINFELDT, Abbe Engineering Co., New York, N. Y.

DESHLER-WALLICK HOTEL: ROOM 216

Tuesday Forenoon, March 31, 1936: 9:30 A.M.–12:00 M.

1. Kyanite

By V. L. Mattson: Burnsville, N. C.

The methods of mining, milling and preparation, sampling, and analysis of kyanite are discussed.

2. Pyrophyllite, A New Deposit Being Developed

By B. C. Burgess: Tennessee Mineral Products Corp., Spruce Pine, N. C.

This deposit is located near Staley, Randolph County, N. C. Its discovery, prospecting, and development are described, as well as its geologic relations, form, structure, and mineralogy. Sampling, analysis, and production methods are given. The paper is illustrated.

3. Magnetic Separation in Ceramics

By Samuel G. Frantz and G. W. Jarman, Jr., Separations Engineering Corp., New York, N. Y.

Progress in magnetic cleaning of ceramic materials is discussed. The best location of magnetic separators is suggested, both for raw materials and finished products before firing, and the sources of iron contamination and best methods of correction are presented.

MATERIALS AND EQUIPMENT DIVISION (continued)

DESHLER-WALLICK HOTEL: ROOM 216

Tuesday Afternoon, March 31, 1936: 2:00 P.M.–4:30 P.M.

4. Size Distribution of Powders as Determined by a Particle-Size Air Analyzer

By Paul S. Roller: U. S. Bureau of Mines, New Brunswick, N. J.

The use of air as a fluid for analytical separation of microscopic-size particles has been given a new impetus by development of a system involving a dynamic relationship between the powder sample and the air jet. This relationship is such that the powder charge is caused automatically to circulate and at the same time to translate in a direction opposite to that of the incoming air. Particle-size analysis embodying this principle is described with the samples related to ceramic materials. Advantages of the air-separation method of analysis are discussed.

5. Particle-Size Measurement by the Hydrometer Method

By Louise B. Harrop, Dept. of Ceramics, Rutgers Univ., New Brunswick, N. J.

An argument is built up for the use of a super-sensitive hydrometer as an instrument for measuring particle size and particle-size distribution in ceramic raw materials. The procedure described makes possible the extension of the range of usefulness of the method beyond any hitherto reported. Comparative data on particle-size distribution in a number of typical clays, obtained by the pipet method (used as a standard) and the hydrometer method, are offered to support the contention that the latter may be considered a workable routine.

6. Size Determination with the Haemacytometer

By C. R. Amberg: Dept. of Ceramic Engineering, N. Y. State College of Ceramics, Alfred, N. Y.

This paper describes a quick microscopic method for determining the average particle size of ground materials finer than 200-mesh. The method is an adaptation of the blood count cell or haemacytometer.

ENAMEL DIVISION PROGRAM

Chairman, R. M. KING, Ohio State University, Columbus, Ohio
Secretary, B. J. SWEO, National Bureau of Standards, Washington, D. C.
Program Chairman, G. H. McINTYRE, Ferro Enamel Corp., Cleveland, Ohio

DESHLER-WALLICK HOTEL: ROOMS A, B, AND C

(Testing Equipment Exhibit: Room 217)

APPLIED RESEARCH PROGRAM: ENAMEL ADHERENCE

Tuesday Forenoon, March 31, 1936: 9:30 A.M.–12:30 P.M.

9:30–10:00 A.M.

1. The Effect of Molybdenum Plating on the Adhesion of Enamel to Steel

By C. R. Amberg, H. D. Prior, and J. C. Richmond: New York State College of Ceramics, Alfred, N. Y.

It has been found that a thin coating of molybdenum on sheet steel will cause a white enamel to adhere. The molybdenum is applied by means of plating with a low voltage current in a bath of a soluble molybdate. The adhesion compares quite favorably with that of blue ground coats.

10:00–10:30 A.M.

2. Mechanics of Enamel Adherence: XII, An X-ray and Chemical Analysis of Some Metallic Precipitates from Cobalt- and Iron Oxide-Bearing Ground Coats

By R. M. King: Dept. of Ceramic Engineering, Ohio State Univ., Columbus, Ohio

A method is described by which metallic precipitates can be separated from the melt and analyzed. The results from X-ray and chemical examination show the relation between the ratio of iron and cobalt concentrations in the melt and the ratio of iron and cobalt concentrations in metallic precipitates.

10:30–11:00 A.M.

3. Mechanics of Enamel Adherence: XIII, A Spectrographic Study of Some Metallic Precipitates from Cobalt- and Iron Oxide-Bearing Ground Coats

By Wallace R. Brode and R. M. King: Dept. of Ceramic Engineering, Ohio State Univ., Columbus, Ohio

The results of spectrographic analyses of the metallic precipitates described in Part XII of this series are presented.

11:00–11:30 A.M.

4. The Effect of Iron Surface Preparation upon Enamel Adherence

By Karl Kautz: Republic Steel Corp., Massillon, Ohio

Photomicrographs of iron surfaces prepared for enameling by various methods are shown. Photomicrographs of these iron surfaces with attached ground-coat enamels at different stages of firing are also shown. The results of adherence tests upon these various enameled surfaces are given.

11:30–12:00 M.

5. A Critical Analysis of Some Statements and Experiments on the Adherence of Sheet-Steel Ground Coats

By James O. Lord: Dept. of Metallurgy, Ohio State Univ., Columbus, Ohio

A review and discussion is presented of the developments in the study of enamel adherence, notably in the publications of Kautz, Staley, and King.

12:00–12:30 P.M.

6. The Relationship of Ground-Coat Adherence to the Elastic Limit of Sheet Steel

By George Sirovy and E. P. Czolgos: Century Vitreous Enamel Co., Chicago, Ill.

By means of an Olsen steel tensile-strength testing machine, ground-coated sheet steel samples of 14, 16, 18, 20, 22, and 24 gages were subjected to tensile stresses.

It was noted that ground-coat chippage occurred immediately upon passing the elastic limit of the steel.

ENAMEL DIVISION PROGRAM (continued)

DESHLER-WALLICK HOTEL: ROOMS A, B, AND C

APPLIED RESEARCH PROGRAM (continued)

Tuesday Afternoon, March 31, 1936: 2:00 P.M.–5:00 P.M.

2:00–2:30 P.M.

7. Microscopic Studies of the Reboiling Phenomenon

By J. O. Lord and D. S. Connelly: Dept. of Metallurgy, Ohio State Univ., Columbus, Ohio

Photomicrographs of enameled sheets at high temperatures giving the different stages of the reboiling cycle and observations and deductions therefrom are presented.

2:30–3:00 P.M.

8. Consistency of Some Enamels at and near Firing Temperatures

By W. N. Harrison and R. E. Stephens: National Bureau of Standards, Washington, D. C.

The apparatus and method of measurement are described, and results on some ground-coat and cover-coat

enamels given. The sheet-iron ground coats appeared to be viscous fluids at the temperatures used, but the opaque cover coats showed unmistakable plastic or non-Newtonian tendencies.

3:00–3:30 P.M.

9. The Integral Expansion of Vitreous Enamels between the Softening Point and Room Temperature

By J. E. Rosenberg and A. Langerman: O. Hommel Co., Pittsburgh, Pa.

The differential expansion of vitreous enamels and base metal is estimated from the mechanical properties of a closed ring of the sheet metal covered on the outside with enamel. An equation is derived relating the tangential static force necessary to overcome the stress in the ring to the coefficient of expansion and elastic properties of the enamel. The equation is reduced to linear form and a plot gives accurately $(\alpha s - \alpha e)\Delta T$, where αs and αe are respectively the average coefficients of the steel and the enamel in the temperature interval, ΔT, between the softening point of the enamel and room temperature. The results by this method are in good agreement with those obtained by interferometer measurements.

3:30–4:00 P.M.

10. The Elastic Properties of Vitreous Enamel

By J. E. Rosenberg and A. Langerman

The elastic properties of thin sheets of enamel are studied by the beam-deflection method. The problem has been the preparation of the samples for study. Thin layers of vitreous enamel are produced by applying and firing the enamel on chromium-plated steel or high chrome-alloy steel. The enamel does not adhere to the metal and can be removed without rupture. The results of these measurements are compared with those obtained by firing the enamel on the outside of a sheet ring of the base metal. The elastic properties of typical enamels are given.

4:00–4:30 P.M.

11. Frit Solubility and Effect on Enamel Slips

By G. H. McIntyre and R. E. Bevis: Ferro Enamel Corp., Cleveland, Ohio

Frit solubilities were determined (1) by extraction in standard Soxhlet extraction apparatus and (2) by milling in the usual manner. Titrations were made both by the potentiometric method, using the glass electrode and the usual indicator method.

The relationship between these soluble portions of the frit and enamel slip consistency were studied.

4:30–5:00 P.M.

11a. Effect of Soluble Salts Formed during Aging on the Scumming of Enamels

By R. J. Whitesell: Rohm & Haas Co., Philadelphia, Pa.

Enamel slips were milled using three typical commercial frits. Representative samples were aged for different lengths of time and at varying temperatures. At the end of its individual aging treatment, portions of each sample were filtered, Na_2O and B_2O_3 being determined on all filtrates.

The remaining slip from each sample was then used to spray sample plates which were fired at the critical temperature for the formation of scum on enamel. A correlation of the data on soluble salts and of the data on scumming is made.

ENAMEL DIVISION PROGRAM (continued)

DESHLER-WALLICK HOTEL: ROOMS A, B, AND C

(Exhibit of Testing Equipment: Room 217)

PHYSICAL TESTING PROGRAM: METHODS AND APPARATUS

Wednesday Forenoon, April 1, 1936: 9:30 A.M.–12:00 M.

9:30–10:00 A.M.

12. Measurement and Significance of Enamel Thickness

By H. H. Holscher: Edison General Electric Appliance Co., Chicago, Ill.

Using the electric enamel-thickness gage, a study of broken enamel parts from the assembly and field has shown that it is more economical to take an immediate scrap loss on all parts which have an enamel thickness of 0.026 to 0.027 inch or more than to use the parts and pay the subsequent replacement costs. A brief discussion of the gage and its uses in the enamel shop is also given.

10:00–10:30 A.M.

13. Color Measurements

By J. L. Michaelson: General Engineering Lab., General Electric Co., Schenectady, N. Y.

There is a growing need in the enamel industry for accurate specification of color. This paper is a discussion of the objective methods of color specification and instruments for measuring color.

10:30–11:00 A.M.

14. The Specification of Light-Scattering Materials

By Deane B. Judd and W. N. Harrison: National Bureau of Standards, Washington, D. C.

In 1931, Kubelka and Munk worked out the relationship between reflectance and thickness of material for thin homogeneous layers illuminated diffusely. In the equation expressing this relationship, hypothetical ideal material is defined by two constants, reflectivity and coefficient of scatter. In the present paper are presented data demonstrating how well the materials of commerce can be specified by these constants. These include data on porcelain enamel, dental silicate cement, paint, and paper, but special attention will be paid to enamels in this presentation.

11:00–11:30 A.M.

15. Methods of Determining Gloss

By Richard S. Hunter: National Bureau of Standards, Washington, D. C.

Glossiness is a part of the appearance of many types of materials, and the problems of determining and measuring gloss are problems of determining and measuring factors which affect appearance. Surfaces which exhibit glossiness can be conveniently classified into five types according to the characteristics of appearance which influence observers in their evaluation of gloss. These five characteristics of surface appearance by which observers may grade gloss are (1) shininess (mirror reflectance), (2) contrast between high-light areas and adjacent areas, (3) sharpness and distinctness of images reflected in glossy surfaces, (4) "bloom," or reflection haze, adjacent to reflected images, and (5) surface texture.

Many of the gloss comparisons in porcelain enamels and other ceramic products are made by means of the distinctness of reflected images, but any of the other four factors may serve to influence a person's judgment of the gloss of such products.

Instruments and methods of gloss measurement and gloss grading are described.

11:30–12:00 M.

16. A Null Method Photoelectric Reflectometer

By Richard S. Hunter: National Bureau of Standards, Washington, D. C.

This instrument is used to measure apparent reflectance for daylight and for light transmitted through colored filters. The test surface and a comparison surface are at opposite ends of a light tunnel and are illuminated normally by the single lamp which is movable between them. Two rectifier-type photoelectric cells are placed so that each receives light reflected at an average of 45° from one of the surfaces. The two cells are connected in series and a galvanometer is connected across them to indicate when one cell generates a current greater than the other. The reflectance scale moves with the lamp past a stationary indicator.

To determine apparent reflectances, a standard is first placed in the test end of the instrument and the lamp is moved to the position for which the scale reads the reflectance value of the standard. By means of a compensating shutter, the light falling on one or the other of the photocells is then reduced until the galvanometer reads zero. When the instrument has thus been adjusted to give the correct reading for the standard, unknown surfaces may be substituted for the standard and their apparent reflectances measured directly.

The instrument is demonstrated and some of its applications are discussed.

ENAMEL DIVISION PROGRAM (continued)

DESHLER-WALLICK HOTEL: ROOMS A, B, AND C

(Testing Equipment Exhibit: Room 217)

PHYSICAL TESTING PROGRAM: METHODS AND APPARATUS (continued)

Wednesday Afternoon, April 1, 1936; 2:00 P.M.–5:30 P.M.

2:00–2:30 P.M.

17. Report of Committee on Standardization of Tests
(a) Developments during 1935 Affecting Standardized Testing in the Enamel Industry

By D. G. Bennett: Mellon Institute, Pittsburgh, Pa.

Wider uses of and refinements in porcelain enamel bring up new testing angles. Precision instruments, often developed for use in other fields are finding their way with but slight modification into the enamel industry. The application of modern test methods to enamel troubles hitherto unsolved is frequently indicated.

2:30–3:00 P.M.

(b) The Need of Standard Tests for Enamels

By W. H. Pfeiffer: Frigidaire Div., General Motors Corp., Dayton, Ohio

The present status of testing methods for enamels and enameling and the need for standard methods are discussed. In some cases satisfactory methods are available but need standardization to be universally useful. In other cases, new test methods are necessary to provide for the proper study and development of enamels.

3:00–3:30 P.M.

(c) Desirable Service Tests from the Viewpoint of a Commercial Enamel Laboratory

By G. H. Spencer-Strong: Porcelain Enamel & Mfg. Co., Baltimore, Md.

The desirability of the standardization of simulated service tests now in use in the enameling industry and the need for the development of new tests are discussed. Service tests in use in allied industries are commented on.

3:30–4:00 P.M.

18. A Comparison of Enamels and Glasses

By A. I. Andrews: Dept. of Ceramic Engineering, Univ. of Illinois, Urbana, Ill.

The physical and chemical relations between enamels and glasses in general are discussed, illustrating the importance of a knowledge in both fields to enamel research and development.

4:00–4:30 P.M.

18a. Delayed Ground-Coat Blistering

By G. H. Spencer-Strong and James J. Theodore: Porcelain Enameling Mfg. Co., Baltimore, Md.

Some of the causes of blistering, especially those due to improper pickling or cleaning, are discussed.

4:30–4:45 P.M.

19. Report of the Research Committee

By W. N. Harrison (*Committee Chairman*): National Bureau of Standards, Washington, D. C.

4:45–5:00 P.M.

20. Report of Committee on Data

By C. R. Amberg (*Committee Chairman*): New York State College of Ceramics, Alfred, N. Y.

5:00–5:15 P.M.

21. Report of Committee on Standards of Chemical Analyses

5:15–5:30 P.M.

22. Report of Committee on Enamel Handbook

By C. R. AMBERG (*Committee Chairman*): N. Y. State College of Ceramics, Alfred, N. Y.

ENAMEL DIVISION PROGRAM (continued)

DESHLER-WALLICK HOTEL: ROOMS A, B, AND C

SHOP PRACTICE PROGRAM

Thursday Forenoon, April 2, 1936: 9:00 A.M.–12:45 P.M.

9:00–9:30 A.M.

23. Experiences with Some Shop Troubles in Porcelain Enameling

By F. G. SUTPHEN: American Rolling Mill Co., Middletown, Ohio

Some of the troubles to be found in enameling plants with methods for their correction are described.

9:30–10:00 A.M.

24. Leadless Enamels for Cast Iron

By WILLIAM J. BALDWIN: O. Hommel Co., Pittsburgh, Pa.

The trend to the use of leadless cast-iron enamels in place of the lead-bearing enamels is discussed. Special problems in enameling cast iron with this type of enamel are dealt with showing various defects and their corrections.

10:00–10:30 A.M.

25. Oxidation Control for Firing Ground-Coat Enamels

By W. G. MARTIN: A. O. Smith Corp., Milwaukee, Wis.

This paper discusses the importance of the oxide layer in the formation of bond. Methods of controlling the degree and uniformity of oxidation are described. Certain typical defects are related to the amount of oxidation and the presence of oxygen.

10:30–11:00 A.M.

26. The Chemistry and Mechanics of Metal Cleaning

By D. J. BENOLIEL: Quaker Chemical Products Corp., Conshohocken, Pa.

A discussion is presented of the principles involved in the cleaning of metal for porcelain enameling, including the foreign materials present on the metal and the various types of cleaners both chemical and mechanical. Five classes of cleaners are included.

11:00–11:30 A.M.

27. Electrolytic Cleaning and Pickling of Sheet Iron for Enameling

By A. E. CHESTER AND J. T. IRWIN: Ferro Enamel Corp., Cleveland, Ohio
C. ELLINGER: Toledo Porcelain Enamel Products Co., Toledo, Ohio

A brief résumé of present cleaning and pickling practice together with more detailed information regarding the present status of electric cleaning and pickling in enamel pickle rooms today is presented.

The theories involved in alternating current pickling together with a discussion of results of over a year's commercial operation on jobbing shop work will be discussed in detail.

11:30–12:00 M.

28. Effect of Various Neutralizing Solutions on Ground-Coat Draining

By G. H. MCINTYRE AND P. E. GERDES: Ferro Enamel Corp., Cleveland, Ohio

Six commercial neutralizers were introduced into enamel ground-coat slips in proportion to their relative carryover with the steel. The effect on ground-coat draining was studied by mobilometer data and weight measurements on standard test plates.

12:00–12:30 P.M.

29. Studies of Enamel Segregation in Dipping

By PAUL C. STUFFT, G. H. SPENCER-STRONG, AND JAMES J. THEODORE: Porcelain Enameling Mfg. Co., Baltimore, Md.

A study is presented of enamel particle-size segregation on the sheet during ground-coat dipping and draining. The effects of mill additions, set-up, and grain size upon particle-size segregation are discussed and the application of the findings to practice is commented on.

12:30–12:35 P.M.

30. Report of Committee on Nominations

12:35–12:45 P.M.

31. Installation of Officers

GLASS DIVISION PROGRAM

Chairman, U. E. BOWES, Owens-Illinois Glass Co., Toledo, Ohio
Secretary, S. R. SCHOLES, New York State College of Ceramics, Alfred, N. Y.
Program Chairman, J. S. GREGORIUS, Pittsburgh Plate Glass Co., Creighton, Pa.

NEIL HOUSE: BALL ROOM

Tuesday Forenoon, March 31, 1936: 9:30 A.M.–12:30 P.M.

9:30–10:00 A.M.

1. Otto Schott: a Tribute

BY ALEXANDER SILVERMAN: Dept. of Chemistry, Univ. of Pittsburgh, Pittsburgh, Pa.

10:00–10:30 A.M.

2. Progress Report on the Determination of the Tensile Strength of Glass

BY A. E. BADGER AND W. B. SILVERMAN: Dept. of Ceramic Engineering, Univ. of Illinois, Urbana, Ill.

A brief description of the apparatus used to determine the tensile strength of glass fibers is presented with results for some typical glass compositions.

10:30–11:00 A.M.

3. The Modulus of Elasticity of Glass: (a) Effect of Thermal History; (b) Effect of Temperature Change

BY GUY E. STONG: Corning Glass Works Laboratories, Corning, N. Y.

An apparatus for determining the modulus of elasticity of glass samples is described. The probable error of the determinations is computed to be ±0.2%, the observed precision being ±0.05%. Work is reported showing the effect of previous thermal history on the modulus of elasticity at room temperature and the effect of elevated temperatures on the modulus of elasticity of samples having different thermal histories.

11:00–11:30 A.M.

4. Experiences in Impact Tests of Super-Tough or Heat-Treated Glass

BY E. L. HETTINGER: Willson Products, Inc., Reading, Pa.

The various difficulties of present methods of testing for specific purposes are explained. The vibration breaking point of glass will be shown by samples of glass projected upon the screen. Reference will be made to kinematics of stress.

11:30–12:00 M.

5. Strength and Physical Properties of Fine Glass Fibers and Yarns

BY GAMES SLAYTER: Owens-Illinois Glass Co., Toledo, Ohio

Glass fibers have been produced in large quantities running from 0.0007- to 0.00005-inch fiber diameter. The strength of individual fibers and the strength of yarns produced from these fibers have received preliminary investigation. Some of the strengths obtained are quite remarkable, running into the order of $1^1/_2$ million lb. per sq. in. Even these strengths fall short of the theoretical possibilities. Some possible reasons and explanations are discussed.

12:00–12:30 P.M.

6. The Abrasion of Glasses as Related to Composition

BY S. R. SCHOLES: Dept. of Glass Technology, N. Y. State College of Ceramics, Alfred, N. Y.

Loaded glass rods are held in a thick metal disk rotating above a rotating steel plate fed with wet flint as an abrasive. Fused silica rods are ground with each run as a standard. The loss by abrasion, corrected for load and diameter, is reported for a number of compositions.

GLASS DIVISION PROGRAM (continued)

NEIL HOUSE: BALL ROOM

Tuesday Afternoon, March 31, 1936: 2:00 P.M.–4:30 P.M.

2:00–2:30 P.M.

7. Solubility Characteristics of Glasses Basically Different in Composition

BY W. C. TAYLOR AND R. D. SMITH: Corning Glass Works Laboratories, Corning, N. Y.

Comparative results are given using the American Ceramic Society No. 1 powder method on several glasses representing lime, lead, and borosilicate compositions. The effect of temperature on rate of attack and some comparisons of surface attack to the powder method are given.

2:30–3:00 P.M.

8. The Area of Glass Particles as Used in Durability Tests

BY J. E. FERGUSON AND KARL LARK-HOROVITZ: Dept. of Physics, Purdue Univ., Lafayette, Ind.

Commercial bottle glass, Pyrex-brand glass, and a lead glass were crushed as prescribed for durability tests. The shape and size of the particles were determined microscopically, and the gross surface was determined from the relation between density, specific surface, S, and particle size, r, as

$$S = C \cdot \frac{1}{rd}$$

Where d = density of glass.
C = a constant depending on shape of particle.

The surface was determined using an adsorption method

developed by one of the authors (*Phys. Rev.*, **29**, 617 (1927)), which employs oleic acid as adsorptive. The surface calculated, assuming a monomolecular layer of oleic acid on the glass surface, is comparable for the different glasses but is only a small fraction of the total surface available. This agrees with results obtained by other investigators on the distribution of dyes on glass surfaces.

3:00–3:30 P.M.

9. Some Preliminary Observations on Reactions between Glass and Phosphate Solutions

By Arthur S. Watts: Dept. of Ceramic Engineering, Ohio State Univ., Columbus, Ohio
J. B. Brown: Physiological Chemistry Dept., Ohio State Univ.

An unusual reaction has been observed in some tests of glasses for chemical solubility.

3:30–4:00 P.M.

10. Devitrification Rates as Governed by Viscosity

By Howard R. Lillie: Corning Glass Works Laboratories, Corning, N. Y.

A simple expression for devitrification rate (relative to a maximum rate) as a function of temperature is derived from a consideration of free energy changes. With the liquidus temperature and the viscosity relations known, relative rates of crystal growth may be computed which agree very well with those observed by Dietzel. At present no attempt is made to predict absolute rates.

4:00–4:30 P.M.

11. Effects of Replacing Dolomitic Lime by Baryta upon Some Properties of Glass

By Vincent E. Wessels: N. Y. State College of Ceramics, Alfred, N. Y.

The effect of replacing dolomitic lime, both in weight percentage and molecularly, by baryta upon the chemical durability, softening temperature, coefficient of linear expansion, density, index of refraction, elasticity, and several other properties was studied. A discussion is presented of the methods, apparatus, and results.

GLASS DIVISION PROGRAM (continued)

NEIL HOUSE: BALL ROOM

Wednesday Forenoon, April 1, 1936: 9:30 A.M.–12:00 M.

9:30–10:00 A.M.

12. Fourier Analysis of X-Ray Patterns of Vitreous SiO_2 and B_2O_3

By B. E. Warren: Massachusetts Institute of Technology, Cambridge, Mass.

The X-ray scattering curves for vitreous SiO_2 and B_2O_3 are obtained in a vacuum camera, using monochromated Mo and Cu radiation. A Fourier analysis of the scattering curve gives directly a curve representing the distribution of neighboring atoms about any one atom. For SiO_2, the distribution curve establishes definitely the tetrahedral silicon-oxygen network. The distribution curve for B_2O_3 indicates a triangular coördination, each boron surrounded by 3 oxygens, and each oxygen shared between 2 borons. For both materials, the interatomic distances come out in excellent agreement with the results of previous crystalline investigations. The importance of the new Fourier method of analysis of glass diffraction patterns is emphasized by the fact that the distribution curves which are obtained are unique, no assumptions as to structure being involved.

10:00–10:30 A.M.

13. Motion Picture Analysis of Annealing

By Howard R. Lillie: Corning Glass Works Laboratories, Corning, N. Y.

By means of motion pictures, the complete strain pattern in a sample can be observed at definite intervals during annealing, subsequent analysis being thereby facilitated. The present work deals with relative stress release rates observed at different depths in the glass. Motion pictures of the annealing process at various temperatures are shown.

10:30–11:00 A.M.

14. The Electrical Conductivity of Glass in the Annealing Zone as a Function of Time and Temperature

By J. T. Littleton and Warren A. Wetmore: Corning Glass Works Laboratories, Corning, N. Y.

It is shown by measurements on samples of glasses having a varied degree of heat treatment that the electrical conductivity of glasses undergoes a stabilization process at constant temperature and that this rate of stabilization is a function of the viscosity of the glass. The resistance of the stabilized glass varies linearly with $1/T$, where T is the absolute temperature, and no change in the slope of this curve is observed. In other words, there is no transformation point observable when all measurements are made on stabilized glass.

11:00–11:30 A.M.

15. Circulation of Glass in Tanks

By F. W. Preston: Butler, Pa.

The circulation of glass in an ordinary tank is compared by analogy with the circulation of water in the Mediterranean and Black Seas and with the flow of lava in Kilauea Crater. It is argued that the shape of the flux-line erosion shows that two factors are active, one essentially chemical and the other physical. This is shown by analogy with the canyons of the West and the V-shaped valleys of the East. Some parts of the subject seem susceptible to mathematical treatment and an effort is made so to treat them.

11:30–12:00 M.

16. An Application of Henry's Law to the Routine Determination of Boron in Glass

By Francis W. Glaze and A. N. Finn: National Bureau of Standards, Washington, D. C.

A method for the routine determination of boric oxide in glass, based on Henry's law, has been developed. It depends upon the "partition" of boric acid between water and ether in the presence of hydrochloric acid and ethanol. A slightly acid solution of the fusion of the glass is shaken with ether and ethanol, and the boric acid in the ether layer is titrated. The "partition coefficient" is 0.406. Barium, fluorine, and zinc interfere to some extent. The advantages of this method are its speed and simplicity without material sacrifice of accuracy.

GLASS DIVISION LUNCHEON

Wednesday Noon, April 1, 1936: 12:15 P.M.–1:45 P.M.

NEIL HOUSE: BALL ROOM

Wednesday Afternoon, April 1, 1936: 2:00 P.M.–4:05 P.M.

2:00–2:25 P.M.

17. The Cutting of Fine Lines in Glass

By C. G. Peters and Frederick Knoop: National Bureau of Standards, Washington, D. C.

In attempts to rule fine lines in glass for the production of transparent line standards, it was found that the glass shattered, leaving irregular lines. After considerable experimenting with ground diamond points, the authors succeeded in ruling fine, straight-edged lines in glass. It was thought that this method might be used to ascertain the relative hardness or relative resistivity to scratching of different glasses. For this work, it was necessary to produce suitable ground diamond tools and to investigate the cutting angles, adjustment, and wear of the diamond points. Measurements were made on a number of different glasses to determine the widths of the lines produced by a given adjustment and load of the point. Measurements were also made to determine the load required to produce shattering under a given adjustment of the tool.

2:25–2:50 P.M.

18. The Scratch-Resisting Power of Glass and the Measurement Thereof

By James Bailey: Bailey and Sharp Co., Inc., Hamburg, N. Y.

The mechanics of disrupting a glass surface are discussed and it is concluded that the scratch-resisting power of the surface is determined by its ability to withstand initial rupture. An apparatus of the rolling-ball type for finding the pressure at which a steel ball first makes conchoidal fractures in the surface of a sample of glass is described and some results are given. A wide variation is found in the hardness of different parts of the same fire-polished surface.

2:50–3:15 P.M.

19. The Effect of Alumina on the Surface Tension of Molten Glass

By C. W. Parmelee and C. G. Harman: Dept. of Ceramic Engineering, Univ. of Illinois, Urbana, Ill.

The maximum-bubble-pressure method has been used to determine the surface tensions of molten glasses. The compositions of the glasses were those typical of certain types of commercial products. A brief summary of the theory and application of the method is presented. The surface tensions of the glasses studied were of the order of 300 dynes per centimeter and the temperature coefficients were 0.017 dyne per centimeter per °C. It was found that Al_2O_3 raised the surface tension of soda-lime-silica glass, the increase being linear between 2% Al_2O_3 and 8% Al_2O_3, but apparently not linear below 2% Al_2O_3.

3:15–3:40 P.M.

20. The Constitution of Lead Oxide-Silica Glasses. Part I: The Atomic Arrangement

By George J. Bair: Dept. of Ceramic Engineering, Pennsylvania State College, State College, Pa.

An X-ray investigation of a series of lead oxide-silica glasses gives further evidence of a continuous random, three-dimensional network of atoms for the structure of glass. The structure of lead oxide-silica glasses is similar to that obtained for soda-silica glasses by Warren and Loring.

3:40–4:05 P.M.

21. Part II: The Correlation of the Physical Properties with the Atomic Arrangement

By George J. Bair

Various physical properties of a series of lead oxide-silica glasses were determined. The variations of these properties with composition and temperature are explained on the basis of a continuous, random, three-dimensional network structure. Justification of Adams and Williamson's equation for the rate of strain release in a glass is obtained by assuming that the flow of a glass fiber in the annealing range is a combination of an elastic stretch and a true viscous flow of a glass of constant viscosity.

REFRACTORIES DIVISION PROGRAM

Chairman, R. B. SOSMAN, United States Steel Corp., Kearny, N. J.
Secretary, H. M. KRANER, Bethlehem Steel Co., Bethlehem, Pa.
Program Chairman, NELSON W. TAYLOR, Pennsylvania State College, State College, Pa.

DESHLER-WALLICK HOTEL: BALL ROOM

Tuesday Forenoon, March 31, 1936: 9:30 A.M.–12:00 M.

9:30–10:00 A.M.

1. The Use of Penetrating Radiations in the Measurement of the Porosity of Refractory Brick (published *Jour. Amer. Ceram. Soc.*, **19** [2] 29–36 (1936))

By J. B. AUSTIN: United States Steel Corp., Kearny, N. J.

The possibility of using the absorption of X-rays or γ-rays in a refractory brick as a measure of porosity has been tested experimentally for both kinds of radiation. It is found that the method is entirely practical in either case and once the necessary apparatus is set up it should yield results better than those now obtained by the displacement method and with much less effort. Gamma-rays from radium appear to have some advantages over X-rays.

10:00–10:30 A.M.

2. Testing Refractories against the Corrosive Action of Electric-Furnace Phosphate Slags

By GORDON R. POLE AND D. G. MOORE: Fertilizer Dept., Tennessee Valley Authority, Wilson Dam, Ala.

A new method was developed as a means of testing refractories against molten phosphate furnace slag at 1450°C. The slag was essentially a monocalcium silicate. Brick with $13^1/_2$- by $4^1/_2$- by $2^1/_2$-inch dimensions were used as test specimens. An oil-fired pot-type furnace 24 inches in diameter and 12 inches deep was used for the test. Four refractories were tested at one time by this method. The test brick were suspended from a Carbofrax crown and dipped $2^1/_2$ inches into the molten slag bath. The degree of corrosion was measured by determining the volume and weight losses of the refractory. Petrographic studies were made on a number of the brick after testing. Quantitative data on 22 brands of refractories tested by this means are given.

10:30–11:00 A.M.

3. Mullite Development in Super-Fireclay Brick

By FRED A. HARVEY AND RAYMOND E. BIRCH: Harbison-Walker Refractories Co., Pittsburgh, Pa.

Specimens of super-fireclay brick, fired to cones 11, 13, and 18, were compared to determine the amount of mullite developed. X-ray diffraction patterns of the three specimens compared with standard samples containing 40, 50, and 60% mullite indicated that all three specimens contained approximately 50% mullite. Petrographic examination showed distinct mullite crystals in the specimen fired to cone 18, while no mullite crystals could be identified in the specimen fired to cone 11. It is concluded that firing to higher temperatures than cone 11 increases the size of the mullite crystals but probably not the total amount of mullite present.

11:00–11:30 A.M.

4. The Flow of Ceramic Bodies at Elevated Temperatures

By F. H. NORTON: Laboratory of Ceramics, Massachusetts Inst. of Technology, Cambridge, Mass.

A study is made of the flow characteristics of a porcelain over a considerable range of stress and temperature. In the range of these tests, where the rate varied by a million to one, no lower limit was found to the flow. The flow always reached a steady rate, but this took as much as 400 hours in some cases. The relation of plastic flow to other types is discussed as well as the application of the flow diagram to the load test and the fusion point.

11:30–12:00 M.

5. Refractories in Metallurgical Industries

By JOHN D. SULLIVAN AND CLYDE E. WILLIAMS: Battelle Memorial Institute, Columbus, Ohio

Refractory performance, requirements, and life in the major metallurgical industries are discussed and the effect of improvements of refractories on metallurgical products and the life of furnaces is outlined. Newer refractory products are discussed and the place they are finding in the metallurgical industries mentioned.

REFRACTORIES DIVISION PROGRAM (continued)

DESHLER-WALLICK HOTEL: BALL ROOM

Tuesday Afternoon, March 31, 1936: 2:00 P.M.–4:30 P.M.

2:00–2:30 P.M.

6. The Impact Abrasion-Hardness of Certain Minerals and Ceramic Products

By LOWELL H. MILLIGAN: Norton Co., Worcester, Mass.

Impact abrasion was produced by an accurately controlled blast of "standard Ottawa quartz sand" in a machine made by the Carl Zeiss Co. The "abrasion-hardness" of various glasses, minerals, hotel chinaware, porcelains, abrasive, refractory, and miscellaneous materials was thus determined in comparison with plate glass which was chosen as a standard. A relationship between crystallographic orientation and abrasion hardness was demonstrated in the case of feldspar and quartz crystals. A Brazilian quartz crystal was found to have trigonal and not hexagonal abrasion-hardness symmetry. The hardness of hotel chinaware and of porcelains tested ranged from 3.2 to 7, with the surface skin on one sillimanite-type porcelain giving the high value of 34 (plate glass standard = 1.00). Crystalline α-alumina gave a value of about 40 and silicon carbide about 400. Experiments with abrading grains other than quartz sand showed that corresponding hardness values for such hard materials as crystalline α-

alumina and silicon carbide come much closer together when hard artificial abrasive grains are used for the blasting.

2:30–3:00 P.M.

7. A Comparison of the Thermal Expansion of Used Silica Brick from an Insulated and an Uninsulated Basic Open-Hearth Roof

By R. H. H. Pierce, Jr., and J. B. Austin: Research Lab., United States Steel Corp., Kearny, N. J.

Measurements of the linear thermal expansion of different zones in the used silica roof brick, whose composition and structure have been reported by Harvey,* show that along the length of the brick there are two abrupt changes in expansion. The first, whose existence was predicted by Harvey, coincides with the limit of penetration of iron oxide and arises from the fact that in the presence of iron oxide the silica, which was originally present as cristobalite, has been converted almost entirely to tridymite which has a different expansion. Since the limit of penetration of iron oxide is that level at which the average temperature is 1100°C (2010°F), the temperature of the ternary eutectic in the system CaO–FeO–SiO_2, this abrupt change, and therefore the zone of weakness, is to be expected after equilibrium has been established in any open-hearth roof brick whose cold end is below 1100°C (2010°F). The second change, which is also due to a discontinuity in the nature or distribution of cristobalite, occurs at that level in the brick at which the average temperature was 1470°C (2680°F), the lower limit of the stable range for cristobalite. The silica is almost entirely in this form, whereas zone 2 contains chiefly tridymite. In both cases the differences in expansion arise directly from a difference in the length-change at the cristobalite inversion which takes place at approximately 250°C (480°F), so that the greatest danger from failure or spalling comes when the roof is cooled below or heated through this temperature. The expansion data also show that the inversion temperature of cristobalite increases regularly with the temperature of its formation.

The data obtained enable the determination of the average distribution of temperature through the brick in service, which, combined with existing data on thermal conductivity of silica brick, permits an estimation of the mean thermal conductivity of that part of the brick into which iron oxide had penetrated. This conductivity is greater than that of the rest of the brick and has a negative temperature coefficient in contrast to the positive coefficient for the unaltered part.

* F. A. Harvey, "Comparison of Used Silica Brick from Insulated and Uninsulated Basic Open-Hearth Roofs," *Jour. Amer. Ceram. Soc.*, **18** [3] 86–94 (1935).

3:00–3:30 P.M.

8. Young's Modulus of Elasticity and Strength of Refractories in Tension

By R. A. Heindl and L. E. Mong: National Bureau of Standards, Washington, D. C.

The nature of heated refractory products is such as to have discouraged study of their tensile properties. The Tuckerman optical strain gage, however, has eliminated many of the difficulties which might be encountered so that strain measurements may be made accurately of materials as brittle as fireclay brick. The National Bureau of Standards has undertaken an extensive study of the tensile properties of commercial- and laboratory-prepared specimens, and this report gives information on sixteen commercial brands of fireclay brick and one each of silica, chrome, forsterite, mullite, and 60 and 80% alumina. Information is given also which shows the variation of the structure in individual brick as indicated by the tensile properties of specimens cut parallel or perpendicular to the 9-inch dimension.

3:30–4:00 P.M.

9. Note on the Appearance of Quartz as a Devitrification Product of Vitreous Silica

By L. J. Trostel: General Refractories Co., Baltimore, Md.

Quartz has been observed as a devitrification product of vitreous silica prepared from glass sand when heated for four hours at 1300°C. Another type of commercial vitreous silica did not devitrify under the same conditions. Examination of the various properties of the two samples of vitreous silica by means of the microscope, interferometer, and X-ray, did not disclose differences which would explain the cause of the devitrification. Several theories are advanced to explain the phenomena observed.

4:00–4:30 P.M.

10. Effect of Heat Treatment on the Thermal Expansion of Some Silica-Alumina Glasses

By C. W. Parmelee and C. L. Thompson: Dept. of Ceramic Engineering, Univ. of Illinois, Urbana, Ill.

Glasses composed of silica and alumina ranging in composition from 95% SiO_2 to 66% SiO_2 were made. It was found that, with the exception of the most siliceous glass, all samples stopped expanding at about 700°C and began to shrink at 900°C. The expansion of the same specimens upon reheating was essentially the same, but they continued to expand to 950°C, after which shrinkage began. After being held at 1000°C for 44 hours, the expansion was approximately one-third greater than that of untreated samples and changed but little upon additional heat treatment.

The heat-treated samples show an increased index of refraction and permanent shrinkage. Under high magnification, the samples appeared glassy and free from crystallization, but X-ray examination shows that the changes in properties were due to the formation of submicroscopic crystals of mullite.

REFRACTORIES DIVISION PROGRAM (continued)

DESHLER-WALLICK HOTEL: BALL ROOM

Wednesday Forenoon, April 1, 1936: 9:15 A.M.–12:00 M.

SYMPOSIUM ON PRODUCTION OF DENSE AGGREGATES

9:15–9:30 A.M.

11. Introduction to the Symposium

By Nelson W. Taylor: Dept. of Ceramics, Pennsylvania State College, State College, Pa.

This Symposium has been organized in response to a wide demand for a group discussion on the principles of space-filling by solid grains of different sizes and shapes. In view of the importance of grain preparation in relation to the packing problem, two papers are presented on the fundamentals of crushing and grinding.

9:30–10:00 A.M.

12. Factors Affecting Creation of Fine Particles for Ceramic Industries

By Lincoln T. Work: Dept. of Chemical Engineering, Columbia Univ., New York N. Y.

This paper constitutes an analysis of crushing and pulverizing processes and alternative methods for the preparation of fine particle size. Size-distribution curves are discussed as well as the present state of the laws of grinding. The effect of classifying devices on size-distribution curves is also noted. The newer aspects of the disintegration problem and the classification problem are noted and trends for further research are discussed.

10:00–10:30 A.M.

13. Some New Viewpoints on Crushing

By R. S. Dean: Metal Div., U. S. Bureau of Mines, Washington, D. C.

The Rittinger law of crushing, that the work required is proportional to the new surface produced, has been assumed to be of general application on the basis of its demonstration for quartz by Gross and Zimmerley. Recent work on the coercive force of magnetite powders has provided a simple and rapid method of measuring surface and has permitted the experimental demonstration of the Rittinger law for magnetite. The use of this material permits an accurate and rapid evaluation of the efficiency of a grinding machine.

The coercive-force surface relationship also permits the determination of a crushing law for plastic solids. For iron it is found that the work used is proportional to the square of the internal surface produced. The complete crushing law for a solid may then be written

$$kW = \Delta S + \Delta(iS)^2.$$

It is a matter of common knowledge that the plastic deformation which a solid undergoes before fracture is greater when the rate of load application is slow. This subject has been studied mathematically, and it is found there is a definite rate of deformation for every solid above which fracture occurs; below this rate internal surface is formed. The rate of deformation is an exponential function of the applied force. The problem in comminuting plastic solids is to apply large forces efficiently to fine particles. Two new methods have been developed for this, *i.e.*, explosion shattering and nozzle crushing. The application of these to ceramic crushing problems is briefly considered.

10:30–11:00 A.M.

14. Gradings for High Density

By F. O. Anderegg: Owens-Illinois Glass Co., Newark, Ohio

Two systems of broken solids give good packing, including gap and continuous grading. The former gives the densest packing but tends to segregate and be harsh in application, requiring special methods such as vibration and/or high pressure. The latter is much more easily worked, segregates less, requires no wasting of intermediate sizes, is often approximated in commercial grinding, and often gives an actual packing as good as the gap grading. Excess in any one size, however, "interferes" with the packing of the coarser particles and should be avoided.

11:00–11:30 A.M.

15. Particle Packing and Particle Shape for Low Porosity Refractories

By H. E. White: Lava Crucible Co. of Pittsburgh, Zelienople, Pa.

S. F. Walton: The Exolon Co., Blasdell, N. Y.

Spherical particles of equal size may theoretically be packed in five different ways: (1) cubical, with a theoretical void space of 47.64%, (2) single stagger or cubical-tetrahedral, with a theoretical void space of 39.55%, (3) double stagger, with a theoretical void space of 30.20%, (4) pyramidal, and (5) tetrahedral (the void space in (4) and (5) is identical, 25.95%).

Secondary, ternary, quaternary, and quinary spheres, each set smaller than its predecessor, may be fitted into the voids in the tetrahedral type of packing, reducing the voids theoretically to 14.9%. Theoretically, the use of a very fine filler in the remaining voids will then reduce them to 3.9%.

The possibility of the use of particles of elliptical shape does not appear to reduce the porosity, but cylindrical-shaped particles properly arranged would reduce the porosity below that possible with spheres.

The practical application of these theoretical methods of packing was studied and the possibility of crushing ceramic materials to spherical shapes is discussed with particular emphasis on the higher priced materials, such as fused alumina, mullite (fused, synthetic, and natural), chromite, magnesite, forsterite, silicon carbide, and also silica, due to the particular rounded character of the natural sand grains.

Instances of changes brought about from heterogeneously shaped grains approaching spheres are shown by the aid of photomicrographs. Study of the experimental work shows the possibility of approaching the theoretical densest packing arrangement by the use of spherically shaped grains. Allowance must be made in some instances for the porosity of the grains themselves. Surface areas may be calculated and bonding media proportioned accordingly. Some commercial refractories of relatively low porosity which were investigated seem to have taken advantage of a careful study of the laws of particle packing, both in the manner of packing of the grog grains and in the shape of the grains themselves.

11:30–12:00 M.

16. Tempering and Forming by Dry Pressing for High Density

By C. M. Dodd: Dept. of Ceramics, Missouri School of Mines and Metallurgy, Rolla, Mo.

Physical properties of unfired, standard-size fire brick formed from mixes ground by dry pan, wet pan, ball mill, rolls, and disintegrator are discussed. Results of a study of the amount of plate-like, needle-like, and chunky grains produced in the larger-size screen fractions by various reduction machines are given. Grain sizing and proportioning of grog and clay mixes for dry-pressing for the production of maximum density are studied. The effects of amount of moisture and the length of time of aging dry-press mixes on the green density of the resultant product are considered. Rate of application, duration, and variation in amount of pressure, and their effect on density are shown.

A comparison is made of the maximum density produced by de-airing dry-press mixes and that produced by the use of endosmosis in dry-press mold-box lubrication.

REFRACTORIES DIVISION LUNCHEON

DESHLER-WALLICK: BALL ROOM

Wednesday Noon: 12:15 P.M.–1:45 P.M.

"Super-Refractories through the Microscope"

Motion picture presented by the Research Department of The Carborundum Co., Buffalo, N. Y., under the direction of R. C. Benner

Wednesday Afternoon, April 1, 1936: 2:00 P.M.–5:30 P.M.

2:00–2:30 P.M.

Business Meeting

2:30–3:00 P.M.

17. Report of Research Committee: "Objectives without Cash" (published in Bull. Amer. Ceram. Soc., **15** [1] 22–28 (1936))

By Donald W. Ross (*Committee Chairman*): Findlay Clay Products Co., Washington, Pa.

3:00–3:30 P.M.

18. Large Special Shapes Made of Insulating Refractory Mixtures

By E. J. Bognar: Corundite Refractories, Inc., Massillon, Ohio

The manufacture of special shapes out of insulating refractories has reached the point wherein one manufacturer has found it expedient to use nine different compositions to supply the various needs of the trade. That is, mixes are made to withstand three different temperatures, *i.e.*, 2000°, 2500°, and 2650°F, and each composition is made in varying weights of 60, 75, and 90 pounds per cubic foot. The mix is now made to suit the job, and fewer failures have been reported where insulating refractory shapes have supplanted those used in the past. Heretofore, only one or two insulating refractory mixtures were available, and they were often recommended for jobs where they were not suited because of their physical limitations.

3:30–4:00 P.M.

19. A New Method for Studying the Flow Characteristics of Glasses and Slags at Elevated Temperatures (published *in Jour. Amer. Ceram. Soc.*, **19** [2] 39–44 (1936))

By Elliott P. Barrett: Mellon Institute, Pittsburgh, Pa.
James A. Taylor: Mineral Industries Expt. Station, Pennsylvania State College, State College, Pa.

Viscosities and surface tensions of glasses and slags are properties of great practical importance but they are frequently difficult to measure. The methods which yield results in absolute units are time-consuming and are not applicable to a study of the behavior of partly devitrified silicate melts.

This paper describes an empirical method for estimating not only the relative fluidity of glasses and slags but also for determining the lowest temperature at which crystallization from a previously chilled vitreous slag will occur on reheating, the approximate rate at which devitrification proceeds at various temperatures, and the range of temperature within which devitrification is complete enough to prevent flow of the slag under its own weight.

By an extension of the method to mixtures of crystalline substances, the behavior of such mixtures upon heating may be studied advantageously. By a further extension of the technique, the temperature at which the solid-liquid interfacial tension becomes low enough to permit wetting of a solid by a glass or slag may be determined. The applicability of these techniques to vitreous enameling problems is indicated.

4:00–4:20 P.M.

20. Note on a Dry-Press De-Airing Device

By C. E. Curtis: Engineering Expt. Station, Ohio State Univ., Columbus, Ohio

Three general methods for de-airing a dry press are (1) double-pressing, (2) use of an easily condensable gas, and (3) direct de-airing. In an investigation of the latter it was found best to evacuate the mold box through holes drilled in the die pads. To keep the holes free of clay, a device called a "cleaning grid" was developed. A description of the construction and operation of an installation of this device is given.

4:20–4:40 P.M.

21. The Freezing of Pyrometric Cones

By R. F. Rea: Engineering Expt. Station, Ohio State Univ., Columbus, Ohio
M. C. Shaw: Edward Orton, Jr., Ceramic Research Foundation, Columbus, Ohio

Pyrometric cones are sometimes subjected to atmospheric or firing conditions which cause a misbehavior known as "freezing." Under such conditions the cone may not come down until a higher temperature, sometimes two or three cones higher, is reached. Definite conclusions have not yet been reached as to the cause of this action. Through petrographic and X-ray analysis, however, certain definite ideas have been formulated which have served as a basis for the development of a series of nonfreezing cones. These cones have been used under conditions where freezing is ordinarily produced and were found to act normally, recording the true heat work.

4:40–5:00 P.M.

22. Chromium Plating for Wear Resistance

By N. H. McKay: United States Chromium Co., Pittsburgh, Pa.

The properties of chromium plating, the methods of producing the coating, and its application to the industry are discussed.

5:00–5:30 P.M.

23. The Mineralogical Composition of Some Refractory Clays

By J. Otis Everhart: Engineering Expt. Station, Ohio State Univ., Columbus, Ohio

The clays discussed in this paper are a group of twenty-one examined in a study of the cause of secondary expansion in flint fire clays. The group is made up of flint, semiflint, and plastic clays from Ohio, Kentucky, Pennsylvania, and Missouri. Data secured from chemical analyses and petrographic and X-ray examinations are presented.

STRUCTURAL CLAY PRODUCTS AND TERRA COTTA DIVISIONS

(Joint Program)

Structural Clay Products Divison Officers

Chairman, A. F. GREAVES-WALKER, University of North Carolina, Raleigh Unit, Raleigh, N. C.
Secretary, G. H. DUNCOMBE, National Aluminate Corporation, Columbus, Ohio
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Chairman, J. L. CARRUTHERS, Ohio State University, Columbus, Ohio
Secretary, H. E. DAVIS, Federal Seaboard Terra Cotta Co., South Amboy, N. J.
Program Chairman, J. L. CARRUTHERS

NEIL HOUSE: RED ROOM

Tuesday Forenoon, March 31, 1936: 9:30 A.M.–12:00 P.M.

9:30–10:00 A.M.

1. Factory Experiences in De-Airing

By T. W. GARVE: 235 West Tenth Ave., Columbus Ohio

A compilation and classification of de-airing data from seventy-five plants (making chiefly structural clayware) with some deductions are presented in this paper.

10:00–10:30 A.M.

2. De-Airing and Drying of Clays

By J. W. WHITTEMORE: Dept. of Ceramic Engineering, Virginia Polytechnic Inst., Blacksburg, Va.

Comparisons were made of the shrinkage and rate of evaporation of water from several clays with and without de-airing. It was found that de-airing decreased the shrinkage and also the rate of evaporation.

10:30–11:00 A.M.

3. De-Airing in the Auger Machine without a Vacuum Pump

By W. D. RICHARDSON: 366 King Ave., Columbus, Ohio

The first presentation of the studies of the cause and prevention of lamination and blistering and the effects of de-airing clay was made in 1923 at the Atlanta Meeting of the Society. Lamination and blistering were relieved by combining the pug mill with the auger machine, accomplishing what had formerly been done in machines with a vertical pugging chamber feeding into a horizontal auger. The first auger brick machine and some facts in the history of its development are discussed.

An investigation of the defective structure of auger-machine products was made in Germany and the United States. The prevention of lamination and blistering without a vacuum pump and the advantages of vacuum-pump de-airing are presented. Other requirements in the design of auger machines are studied, as well as the type of research needed on the proper ratio between the sectional area of the propeller and the area of the die. The German investigation is cited and conclusions are drawn.

11:00–11:30 A.M.

4. De-Airing Sewer Pipe

By J. EDGAR RANKIN: Pine Hall Brick & Pipe Co., Pine Hall, N. C.

The Steele method of de-airing sewer pipe features an air-tight, inclosed mud chamber, fed by an inclosed chute from the de-airing unit, which is connected in a straight line with a 12-foot pug mill. Tempering clay with two wet pans has been discontinued. The plasticity has been increased, the pipes emerge straighter from the press, dry straighter, and are stronger and tougher with a resultant decrease in waste in house and kilns. The outer surface is smoother with practically no lamination or visible blisters. The crushing strength is increased and the absorption decreased.

11:30–12:00 M.

5. Practical and Theoretical De-Airing

By JOHN H. ISENHOUR: G. W. Isenhour & Sons, Salisbury, N. C.

The following points are discussed in this paper: (1) theoretical de-airing, (*a*) theory of colloids, (*b*) effect of de-aired material on metal, (*c*) nature of different materials relative to de-airing, (*d*) unequal density, and (*e*) lamination; (2) drying (*a*) rate of drying, (*b*) drying strength, and (*c*) shrinkage; (3) firing; and (4) practical experiments with de-airing from the machine to the finished product, using three different clays and their combinations.

STRUCTURAL CLAY PRODUCTS AND TERRA COTTA PROGRAM (continued)

NEIL HOUSE: RED ROOM

Tuesday Afternoon, March 31, 1936: 2:00 P.M.–4:30 P.M.

2:00–2:30 P.M.

6. Improved De-Airing Practice in Plant Operation

By ERNEST W. KNAPP: The Bonnot Co., Canton, Ohio

This paper covers data on clay preparation, pugging, de-airing, drying, firing, and cooling. The latest designs in machinery such as augers, dies, and drier equipment will be discussed with data taken on large-scale commer-

cial practice of the latest developments and improvements. Data are also given on results on power savings, reduction of losses, firing time, and improvement in clayware products. The application of the de-airing process to one of the most difficult types of alluvial clays is described.

2:30–3:00 P.M.

7. Method for Improving the Physical Properties of Clays

By J. W. Whittemore and Fred W. Bull: Dept. of Ceramic Engineering, Virginia Polytechnic Inst., Blacksburg, Va.

The effect of an organic material, commercially known as Plasticade, on the physical properties of several clays was studied. The Plasticade is principally an organic compound with a tannin and lignin base and is an acid in its reactions. It has a marked effect on all of the physical properties of the clays studied. Its effect on clays was first studied in the laboratory and then determined from plant trials.

3:00–3:30 P.M.

8. Current Studies of Structural Clay Products at the National Bureau of Standards

By R. T. Stull, D. E. Parsons, and J. W. McBurney: National Bureau of Standards, Washington, D. C.

This paper presents a brief description of the current work on the following projects: (*a*) a study of pore structure of structural clay products and its relation to their resistance to weathering, (*b*) the permeability to water of brick and structural clay tile masonry, (*c*) bond between brick and mortar, and (*d*) the resistance of building brick to freezing and thawing.

3:30–4:00 P.M.

9. Balancing Structural Tile Dies without the Use of Drags and Increasing Capacity

By H. L. Longenecker: Cherokee Brick Co., Macon, Ga.

To produce ware which will not crack in the drier, tile must be extruded from a die at a uniform velocity across the die. It is sometimes difficult to make the clay fill the corners of a large die. In common practice, a die is balanced by placing drags on the rear ends of the core post at the section of the die which runs fast, retarding the clay flow at that point sufficiently to equalize the flow across the die. The difficulty in filling the corners is overcome by making deep semicircular gouges in the die behind the corners.

It has been found better practice to speed the slow parts of the die by altering the taper of cores, shifting the cores sidewise to increase the web thickness at the slow sections, and thinning the web thickness at the fast sections. Gouging the corners is a form of dragging which is overcome by using better design.

Experimental data, drawings, photographs, instructions for die building and balancing, and proper taper of dies and cores are given. A die balanced without drags increases the tonnage per hour and reduces the power requirements.

4:00–4:30 P.M.

10. Metal Wear in Ceramic Plants

By J. O. Everhart: Engineering Expt. Station, Ohio State Univ., Columbus, Ohio

This is a progress report of a coöperative investigation being conducted by the Engineering Experiment Station, Ohio State University, and a group of metal-producing companies at the Ironton Fire Brick Co. plant. Machine parts being studied are pug-mill knives, die liners, dry-pan grinder, and screen plates and muller tires. Forty compositions of pug-mill knives, representing practically all types of commercially produced irons and steels, have been subjected to test. A lesser number of compositions made into die liners, etc., have been tested. Data on the wearing behavior of these materials are presented together with some observations on relative economy.

STRUCTURAL CLAY PRODUCTS AND TERRA COTTA PROGRAM (continued)

NEIL HOUSE: RED ROOM

Wednesday Forenoon, April 1, 1936: 9:30 A.M.–12:30 P.M.

9:30–10:00 A.M.

11. Brittleness in Vacuum-Treated Ceramic Ware

By H. R. Straight: Straight Engineering Co., Adel, Iowa

A discussion is presented of the possible cause of easy chipping in vacuum-treated clayware and a remedy is suggested.

10:00–10:30 A.M.

12. Water-Tight Unit Masonry

By Lee S. Trainor: National Lime Assn., Washington, D. C.

This paper will be presented in the form of an Audi-Vision production through the medium of an electrical transcription. This transcription which carries the message is supplemented by a series of pictures which are projected on a screen and are properly synchronized.

10:30–11:00 A.M.

13. Modular Masonry

By Frederick Heath, Jr.: The Brick Mfrs. Assn. of New England, Worcester, Mass.

The operations of a bricklayer are analyzed and grouped into (1) bedding, including laying, (2) cutting, including fitting, trimming, and grinding, (3) plumbing, including lining and levelling, and (4) jointing, including slushing, patching, and striking joints. The time required for each operation is determined for several different conditions.

11:00–11:30 A.M.

14. Super-Ceramic Building Members

By F. O. Anderegg: Owens-Illinois Glass Co., Newark, Ohio

Ceramic masonry units, properly formed of suitable raw materials and well fired, are characterized by very high compressive strengths. When assembled into building members their usefulness ordinarily is decidedly limited by the weakness of mortar joints; even the inclusion of reinforcing in a mortar joint fails to develop properly the po-

tentialities of the high compressive strengths and stiffness available in the units. Pre-stressing does, in effect, change part of the excess compressive strength into tensile strength, permitting much better application of materials, whether in beams or in columns. In the former, the under side is placed initially under compression while, even in columns, suitable pre-stressing reduces the buckling tendency of slender members which otherwise would cause failure far short of the compressive strength potentialities. Analysis of the pre-stressing and loading operations is secured with the aid of celluloid models and polarized light.

11:30–12:00 M.

15. The General Electric Experimental House at Nela Park

By C. Merrill Barber: Hays & Simpson, Architects, Cleveland, Ohio

The economics of home building demand the most intelligent use of building materials and the most efficient architectural planning. With this as a basic axiom, the General Electric Company, Nela Park, Cleveland, has had a house constructed to show the latest ideas on planning and economic use of materials. Haydite was used for the exterior walls with Portland cement stucco. The house is planned to be merely one design of seven or eight made possible by regrouping certain rooms and units about a constant central combination. This, to a large extent, makes possible with traditional construction the savings of mass production without the apparent evils of monotony or stereotyped plans. This house was not designed as low-cost housing but embodies a principle that can be applied to a group of any cost.

12:00–12:30 A.M.

16. Rostone, Process and Product

By Richard L. Harrison and Paul W. Jones: Rostone, Inc., 308 Main St., Lafayette, Ind.

A description is given of the Rostone process and products and of their commercial application.

STRUCTURAL CLAY PRODUCTS AND TERRA COTTA PROGRAM (continued)

NEIL HOUSE: RED ROOM

Wednesday Afternoon, April 1, 1936: 2:00 P.M.–4:00 P.M.

2:00–2:30 P.M.

17. Some Temperatures within and beneath a Brick Pavement

By H. Z. Schofield: Engineering Expt. Station, Ohio State Univ., Columbus, Ohio

A brief study and comparison are made of temperatures existing over a cross-section of a brick pavement and in the underlying grade. Temperatures were obtained from an arrangement of seventeen thermocouples permanently installed during the pavement construction.

2:30–3:00 P.M.

18. A Progress Report on the Utility of Some New Jointing Compounds in Road Construction

By W. W. Duecker: Mellon Institute, Pittsburgh, Pa.
H. Z. Schofield: Engineering Expt. Station, Ohio State Univ., Columbus, Ohio

In the fall of 1935, a section of brick pavement was constructed in Hocking County, Ohio, and designated as a filler test road. Under normal construction conditions twelve trial fillers were installed in sections of 600 square yards or more. With the Ohio Highway Asphalt Filler F1 as standard, eight bituminous fillers varying from the standard in composition and source were applied. Two sections of the test road were allotted to grout fillers. Of especial interest were two sections of 900 square yards each containing, as the brick joint filler, plasticized sulfurs. Further information regarding the chemical nature of these plasticized sulfurs is revealed as well as observations on this their first use in large-scale pavement construction.

3:00–3:30 P.M.

19. Brick Masonry in State Highway Bridges in Ohio

By J. C. Merrell: Dept. of Highways, State of Ohio, Columbus, Ohio

A review is given of the brick structures of the past and an outline of the uses of brick in the structures of the present day, including a discussion of brick-lined structures for acid-carrying streams as well as the reinforced-brick masonry structures already built or under construction. Some of the more technical problems involved in the design of these structures are presented, such as the reason why the entire structure is not of reinforced-brick masonry, the selection of unit stresses to be used in design, selection of the type of brick and mortar, methods of waterproofing, methods of flashing, particular specifications required, alternate types of brick to be permitted, and some of the difficulties encountered in adapting brick masonry to our structures.

3:30–4:00 P.M.

20. Puerto Rico

By T. W. Garve, 235 West Tenth Ave., Columbus, Ohio

A brief account of the history, geography, population, activity, and clay industry of the Island is presented, including "handmade" pottery, illustrating some old Spanish brick kilns, and citing a few unusual properties of surface clays tested.

WHITE WARES DIVISION PROGRAM

Chairman, T. A. KLINEFELTER, National Bureau of Standards, Washington, D. C.
Secretary, S. J. McDOWELL, General Ceramics Co., Keasbey, N. J.
Program Chairman, V. J. ROEHM, Sebring Pottery Co., Sebring, Ohio

NEIL HOUSE: JUNIOR BALL ROOM

Tuesday Forenoon, March 31, 1936: 9:30 A.M.–12:10 P.M.

9:30–10:00 A.M.

1. Physical-Chemical Reactions in Whiteware

By T. N. McVay: Univ. of Alabama, University, Ala.

The present knowledge concerning reactions which take place during the heat treatment of clay, feldspar, and silica is discussed as well as the relations of these three to the ternary system K_2O–Al_2O_3–SiO_2. Additional experimental data as evidenced by the thermal-expansion curves of clay-feldspar and clay-silica mixtures previously fired at high temperatures are presented.

10:00–10:30 A.M.

2. Glass Phase in Whiteware Products

By G. R. Shelton: National Bureau of Standards, Washington, D. C.

Three kinds of tests are in progress on this problem. Petrographic examinations were made of thin sections prepared from a variety of whiteware products heated at different temperatures to determine the amounts and character of the glassy bonds present.

Another series of tests will be conducted on homogeneous glasses now being prepared by fusion of the chief minerals present in whiteware raw materials, beginning with feldspar and followed by mixtures of feldspar with kaolin, quartz, and muscovite.

To determine the alteration in the properties of whiteware glassy bonds as they dissolve materials commonly found as impurities in the raw materials or purposely added to the batch as artificial fluxing agents, it is necessary to study glasses in multiple-component systems. For this purpose 54 glasses were prepared in the system K_2O–CaO–Al_2O_3–SiO_2. The measurements of coefficient of expansion, critical temperature, annealing range, and softening point have been made and the results correlated with chemical composition. Illustrated with diagrams.

10:30–10:50 A.M.

3. Some Aspects of the Heat Treatment of Whiteware

By F. H. Norton: Laboratory of Ceramics, Massachusetts Inst. of Technology, Cambridge, Mass.

Attention is called to the fact that very little thought has been paid to the heat treatment of whiteware in spite of the fact that evidence points to the important effect of the cooling rate. Some factors of this problem are discussed with a view to stimulating further work in this direction.

10:50–11:10 A.M.

4. Data on the Influence of Firing Time on the Properties of Some Whiteware Bodies

By Arthur S. Watts: Dept. of Ceramic Engineering, Ohio State Univ., Columbus, Ohio

Data have been obtained by firing a variety of whiteware bodies in commercial kilns to a given pyrometric cone deformation at different rates of temperature increase, indicating that the faster rate of firing gives lower water absorption and greater firing shrinkage.

11:10–11:30 A.M.

5. Thermal Decomposition of Talc (published *Jour. Research Nat. Bur. Stand.*, **15** [5] 551–56 (1935); R.P. 848)

By R. H. Ewell, E. N. Bunting, and R. F. Geller: National Bureau of Standards, Washington, D. C.

A nearly pure talc was investigated both unheated and after heating at numerous temperatures ranging up to 1435°C. The studies included the measurement of heat effects, weight losses, and changes in true specific gravity occurring on heating talc. X-ray and microscopical examinations were made of the heated samples.

The talc, from Manchuria, has the following chemical composition: MgO 32.32%, SiO_2 61.34%, CaO trace, R_2O_3 (mostly Al_2O_3) 0.71%, ignition loss 5.81%. Petrographic examination shows at least 95% to have the correct indices of refraction for talc. Whether the small amount of R_2O_3 be ignored or whether it be assumed to be present as Al_2O_3 in kaolinite, the molecular ratio of MgO, SiO_2, and H_2O is very close to 4:5:1.54. This molecular ratio is of interest because it should throw some light on the controversial question of the true formula of talc, since this talc exceeds in purity any heretofore reported in the literature, as far as is known to the authors.

There was no change in the crystal structure of the talc up to 800°C. At 800 to 840°C the talc decomposed to enstatite, amorphous silica, and water-vapor. The enstatite gradually changed to clinoenstatite around 1200° C, and the amorphous silica changed to cristobalite around 1300°C, giving clinoenstatite and cristobalite as final products.

The data support the hypothesis of Foshag and Wherry that water in talc in excess of 1 molecule is not constitutional and may be held electrostatically between basal cleavage planes.

11:30–11:50 A.M.

6. The Effect of Hydrochloric Acid and Ammonia upon the Firing Behavior of Some Reworked Bodies

By Robert Twells: The Electric Auto-Lite Co., Toledo, Ohio

When certain electrical porcelain bodies are shaped by dry grinding them against a rotating wheel, the scrap from the process is finely divided and has a low bulk density. Bodies re-prepared from such scrap tend to blister, and the glaze may contain pinholes after being fired at the maturing temperature of the original body. Vacuum treatment of the scrap body slip does not decrease the blistering, and wet grinding definitely increases the blistering of the reworked body in firing. Experiments were conducted in which hydrochloric acid and ammonia were added separately in gradually increasing quantities to the body scrap. The bodies were re-prepared by blunging the scrap with the electrolyte, cast into disks, glazed, and fired. The reworked bodies containing hydrochloric

acid were blistered similar to the untreated body. Additions of ammonia were more successful. One reworked body low in clay required 0.25% NH_3, and another high in clay required 1.0% NH_3 to eliminate pinholing and blistering under the conditions of the test.

11:50–12:10 P.M.

7. The Effect of Varying Alumina-Silica Ratios and Contents on the Volatility and Firing Characteristics of Lead Glazes

By Laurence E. Kane and Milo A. White, Jr.: Dept. of Ceramic Engineering, Rutgers Univ., New Brunswick, N. J.

A field of typical high-lead fritted glazes, in which the alumina and silica contents were systematically varied, was investigated. This study resulted in the development of several high lead glazes capable of being direct gas-fired at cones 01 to 1. Muffle-firing results are also given. The losses in weight, resulting from heating to the maturing temperatures over definite periods of time, were determined.

WHITE WARES DIVISION PROGRAM (continued)

NEIL HOUSE: JUNIOR BALL ROOM

Tuesday Afternoon, March 31, 1936: 2:00 P.M.–4:20 P.M.

2:00–2:20 P.M.

8. The BaO–Al_2O_3–SiO_2 System

By Warren A. Zimmer and Arthur S. Watts: Dept. of Ceramic Engineering, Ohio State Univ., Columbus, Ohio

A cone deformation study has been made of the members of this series from 0 to 40% Al_2O_3.

2:20–2:40 P.M.

9. The System: K_2O–PbO–SiO_2

By R. F. Geller and E. N. Bunting: National Bureau of Standards, Washington, D. C.

This supplements the report published in *Tech. News Bull.*, No. 211, Nov., 1934. The additional study of this system indicates that it contains four ternary compounds having the molecular ratios 1:2:2, 1:4:8 (previously reported as 1:3:6), 1:1:4, and 2:1:3, respectively, with the possibility of a fifth. The first, crystallizing as hexagonal plates with a melting point at 918°C is uniaxial negative, has indices ω 1.93 ± 0.01, ϵ 1.72 ± 0.01, and the optic axis is perpendicular to the cleavage. The second, crystallizing as well-defined fibers or lathes, melting at 779°, and resembling a short-fibered asbestos when crushed, has indices ranging from 1.69 ± 0.01 to 1.79 ± 0.01, extinction is parallel, and the optic axis is parallel with the longitudinal axis. The third is positive biaxial, crystallizes as rectangular, platy granules of parallel extinction which melt at 757°; the optic angle is about 75° and the indices are α 1.590, β 1.612, γ 1.65. (All indices ±0.005). The fourth is platy with an average index of approximately 1.67; it melts incongruently at 737° and is very unstable.

The index of refraction, linear thermal expansion to 300° C, and the softening temperature of the first three compositions, as glasses, are respectively, 1.775, 0.46%, and 395°C; 1.712, 0.28%, and 460°C; and 1.606, 0.36%, and 463°C. The 2:1:3 compound composition is very unstable as a glass.

2:40–3:00 P.M.

10. Prevention of Spit-Out on Decorated Ware

By C. J. Koenig: Engineering Expt. Station, Ohio State Univ., Columbus, Ohio

A progress report on factors influencing spit-out is presented. While the primary cause of spit-out, as generally conceded, is due to moisture adsorption, other factors such as the presence of carbon and sulfur in body and glaze have important influences. Photomicrographs of various types of spit-out are included.

3:00–3:20 P.M.

11. Lead Frits and Fritted Glazes

By J. H. Koenig: Engineering Expt. Station, Ohio State Univ., Columbus, Ohio

An examination of the present commercial lead frits used in the whiteware trade was made for the resistance of their lead content to dilute acid attack.

Forty lead frits were prepared with a wide range in composition. The solubility characteristics, melting temperatures including initial and complete fusion, softening point, viscosity measurement, and the linear thermal expansion were determined. The glazes and bodies employed were measured for linear thermal expansion. The glaze fit was determined by the autoclave test. The texture of the glazes is shown by photographic means.

3:20–3:40 P.M.

12. Ceric Oxide and Some Other Rare Earth Oxide Mixtures in Glazes

By Byron W. Merwin: Dept. of Ceramic Engineering, Iowa State College, Ames, Iowa

3:40–4:00 P.M.

13. Influence of Glaze Composition on the Mechanical Strength of Electrical Porcelain (published *Jour. Amer. Ceram. Soc.*, **19** [3] 70 (1936))

By L. E. Thiess: General Electric Co., Schenectady, N. Y.

The influence of the glaze composition upon glaze fit and mechanical strength has been studied on a series of commercial and twelve experimental glazes. The latter have a RO constant of 0.3 K_2O, 0.7 CaO, 0.4 to 0.7 Al_2O_3, 2.4 to 5.6% SiO_2. The coefficient of thermal expansion was determined by calculation. Glazes high in fluxes (feldspar and whiting) appear to be unfavorable to high strength and good glaze fit.

4:00–4:20 P.M.

14. Influence of Silica Content on the Thermal Expansion of a Bristol Glaze

By C. L. Thompson: Dept. of Ceramic Engineering, Univ. of Illinois, Urbana, Ill.

An increase in the silica content of a Bristol glaze often results in an increase in the thermal expansion of the glaze. Furthermore, an increase in the alkali content may result in a lower thermal expansion.

4:20–4:40 P.M.

15. The Plasticity of Finely Ground Minerals with Water (published *Jour. Amer. Ceram. Soc.*, **18** [4] 115–20(1936).

By Earl O. Wilson: Massachusetts Inst. of Technology, Cambridge, Mass.

A study is made of the plasticity of finely ground minerals in water. For this purpose a machine was developed to give quantitatively the factors making up plasticity. It is shown that the particle shape is an important factor governing plasticity.

WHITE WARES DIVISION PROGRAM (continued)

NEIL HOUSE: JUNIOR BALL ROOM

Wednesday Forenoon, April 1, 1936: 9:00 A.M.–12:20 P.M.

9:00–9:40 A.M.

16. The Fluxing Effect of Feldspar in Whiteware Bodies

By E. Schramm and F. P. Hall: Onondaga Pottery Co., Syracuse, N. Y.

A review is given of literature dealing with the melting relations of the feldspars, the solubility of quartz and clay in feldspar, the use of feldspar in bodies, and the direct determination of viscosity. An experimental study is reported, based on the determination of vitrification curves and viscosity at high temperature for several types of bodies, employing different typical feldspars alone and in mixtures. Various potash feldspars give similar results when allowance is made for free quartz content. The action of several natural feldspars of intermediate soda content was duplicated with chemically identical blends of pure microcline and pure albite. The validity of chemical control is confirmed. The action of feldspar is best considered not as a simple melting and solution process, but as providing a source of fluxing elements needed to bring about glassforming reactions.

9:40–10:00 A.M.

17. The Effects of Flint, Feldspar, Talc, and Clays on the Moisture-Expansion Characteristics of Whiteware Bodies

By Laurence E. Kane: Dept. of Ceramic Engineering, Rutgers Univ., New Brunswick, N. J.

The main purpose of this investigation was to determine the extent to which clays may aid in eliminating moisture expansion and at the same time attempt to correlate factors which may have direct application to re-hydration and consequent moisture expansion. Results have been obtained which indicate that high clay, moisture-expansion resistant bodies are possible. Contrary to a widely accepted theory, the use of feldspar, and in some cases flint, has proved of benefit in eliminating moisture expansion. Other considerations involve the proportion of expansion attained by autoclave treatments, which is attributable to a permanent thermal expansion.

10:00–10:20 A.M.

18. A Comparison of the Physical Properties of a Series of American and English Ball and China Clays

By Milo A. White, Jr., and Andrew L. Johnson: Dept. of Ceramic Engineering, Rutgers Univ., New Brunswick, N. J.

This paper covers the first part of an investigation of the relative effects of American and English ball and china clays in typical ceramic bodies. A comparison of the results obtained on the raw and fired properties of 74 clays when tested as indivdual materials is given.

10:20–10:40 A.M.

19. Substitution of Domestic for Imported Clays in Whiteware Bodies

By W. W. Meyer and T. A. Klinefelter: National Bureau of Standards, Washington, D. C.

A general procedure for substitutions among whiteware-body materials, based on the chemical and physical properties of the materials involved, is described. The relation of the RO content to the heat treatment required to produce maximum bulk specific gravity of a whiteware body is discussed. The importance of accurate temperature control, especially in experimental work, is emphasized. Whiteware bodies can vary widely in composition and vitrification temperature and yet be uniform in shrinkage during heat treatment and specific gravity if the total clay content is more or less constant. Plastic properties can be varied widely by variations within the clay content.

10:40–11:00 A.M.

20. The Effect of Small Additions of Bentonite and Ball Clay to a Whiteware Mixture

By J. W. Whittemore: Dept. of Ceramic Engineering, Virginia Polytechnic Inst., Blacksburg, Va.

Varying amounts of ball clay and bentonite were added to a whiteware mixture. The effect of the additions on the plasticity and other physical properties was studied.

11:00–11:20 A.M.

21. Mineral Constitution of Various Ceramic Clays

By R. E. Grim: State Geol. Survey Div., Univ. of Illinois. R. H. Bray: Dept. of Agriculture, Univ. of Illinois, Urbana, Ill.

The mineral constitution of samples of ball clay, china clay, Vallendar clay, flint clay, diaspore, shales, brick clays, and fuller's earth has been determined by means of optical, chemical, and X-ray analyses following supercentrifuge fractionation. This technique permits the mineralogical identification of the constituents of the finest fractions, *i.e.*, the so-called colloid fractions of clay materials. Each of the clays investigated, with the exception of diaspore, is essentially composed of one or more of the group of minerals known as the clay minerals, of which kaolinite, beidellite, montmorillonite, and a sericite-like mica are the most important.

On the basis of the foregoing analytical data, the distribution of clay minerals in clays of different types and in different size grade fractions is investigated. The relation between the clay mineral constitution and physical properties is also briefly considered.

Base-exchange capacity determinations are presented and their significance in relation to the mineral composition and physical properties of clays is discussed.

11:20–11:40 A.M.

22. Further Studies of Talc in Whiteware

By R. F. Geller and A. S. Creamer: National Bureau of Standards, Washington, D. C.

Three talcs (high, medium, and very low CaO content) were used in compounding 24 bodies containing from 0 to 3 weight % K_2O·Na_2O introduced as feldspar, in the field of 5 to 15% MgO, 10 to 30% Al_2O_3, 65 to 75% SiO_2. Specimens were formed by extrusion and by dry pressing and heated at cones 4, 6, 8, and 10, respectively.

Determinations were made of linear shrinkage during drying and heating, and the heated specimens were tested for water absorptivity, linear thermal expansion and moisture expansion, and elasticity and strength in bending. From the data, values for extensibility and for the moduli of rupture and elasticity were calculated.

11:40–12:00 M.

23. Expansion of Pyrophyllite

By C. W. Owens and A. F. Greaves-Walker: Dept. of Ceramic Engineering, Univ. of North Carolina, Raleigh, N. C.

The macrocrystalline variety of pyrophyllite is known to expand several hundred per cent in volume during dehydration. In the cryptocrystalline variety the expansion is much less. The results of an investigation of the expansion of a commercial grade such as is used in the whiteware industry is given.

12:00–12:20 P.M.

24. Use of Syenites in Ceramic Bodies

By C. J. Koenig: Engineering Expt. Station, Ohio State Univ., Columbus, Ohio

Results are given on the physical properties of eight bodies, comprising that of a typical semiporcelain and seven bodies incorporating different nepheline syenites, both singly and in combinations with feldspar, respectively. The relative viscosities of four nepheline syenites, a typical potash feldspar, and a soda feldspar are compared at four different temperatures. This study is to be followed by comprehensive plant tests.

WHITE WARES DIVISION PROGRAM (continued)

NEIL HOUSE: JUNIOR BALL ROOM

Wednesday Afternoon, April 1, 1936: 2:00 P.M.–5:30 P.M.

2:00–2:20 P.M.

25. Oxidation-Reduction Potentials and Other Indicators of Microbiological Activity in Aging Clay

By Dudley P. Glick: Agricultural Expt. Sta., Dept. of Bacteriology, Fort Collins, Colo.

The significance of oxidation-reduction potentials is reviewed with recent work of importance.

Studies were made upon the oxidation-reduction characteristics of a clay untreated, and upon the same clay variously treated, during aging. The clay itself provided an index to the state of reduction induced by microörganisms.

2:20–2:40 P.M.

26. The Microbiology of Aging Clays

By Dudley P. Glick.

These investigations were begun in 1931 to determine the validity of the bacterial theory of aging clays.

Clay bodies were examined bacteriologically and the species of microörganisms were identified. In general, the bacterial flora was that of which the habitat is water and the soil. *Achromobacter* species predominated. A ball clay-extract medium was found to support bacterial growth, whereas no growth appeared on a medium made of kaolin extract. On beef-extract agar the number of organisms per cubic centimeter of slip ran as high as 10.5×10^{12}. A method was devised for the examination of the interior of lumps of native clay. These were found to contain no living organisms.

The effects of sterilization and temperature upon the aging of clays was investigated. Living organisms were shown to contribute to the changes accompanying aging. Earlier work on the optimum temperature for aging was verified.

A porcelain body was variously treated with urine, manure-water, tannic acid, peptone, and ammonium nitrate. One series was sterilized, one left in the natural state; all were aged one year and then examined bacteriologically and physically. The phenomenon of thixotropy was pronounced in the samples treated with tannic acid. Oxidation-reduction potentials of samples were determined.

2:40–3:00 P.M.

27. Notes on Missouri Halloysite

By Frank J. Zvanut: Dept. of Ceramic Engineering, Missouri School of Mines and Metallurgy, Rolla, Mo.

A brief discussion of the properties of halloysite is presented, together with the results of tests made on the firing behavior of halloysite from Lawrence County, Mo. The high refractoriness, apparent colloidal nature, and excellent white color are the outstanding favorable qualities, while the extreme firing shrinkage appears to be the only unfavorable feature.

3:00–3:20 P.M.

28. De-Airing in an Ordinary Pug Mill

By Kenneth Stettinius: Lapp Insulator Co., Inc., LeRoy, N. Y.

In the top of the pug mill in the region where the relatively air-free press cakes are being churned and compacted, carbonic acid gas is substituted by displacement for the air, which usually becomes entrapped. The gas goes into solution much more readily. Visible laminations in the pug are eliminated and drying losses are greatly reduced.

3:20–3:40 P.M.

29. The Spray-Drying Process: Some Possible Applications to Ceramics

By Robert Twells: The Electric Auto-Lite Co., Toledo, Ohio

The process of dewatering liquids by spray drying is assuming increasing importance in the chemical industries. Solutions, emulsions, solid-suspensions, and their combinations can be dried quickly, cheaply, and under accurate control. The spray-dried particles tend to be granular and nearly spherical in shape; the product is a dense, free-flowing powder which is especially well adapted to automatic handling, packaging, and dry pressing into shapes. The suggestion is made that materials of low bulk density could be prepared in the liquid state and spray-dried to a dense, granular powder which would be easier to handle and freer from dust than the same materials prepared for dry grinding.

3:40–4:00 P.M.

30. Control of Quality and Installation Requirements for Glazed Tile

By John R. Kauffman: Dept. of Ceramics, Rutgers University, New Brunswick, N. J.

The interpretation of laboratory tests in controlling the quality of tile and their selection and use for various types of installations, procedures, and methods of making the adsorption, autoclave, freezing, thawing, and bonding tests on glazed tile are given.

4:00–4:20 P.M.

31. Colored Ceramic Aggregate for Decorative Concrete

By C. W. Planje: Portland Cement Assn., Chicago, Ill.

The various processes for manufacturing colored glass and colored vitrified ceramic particles for use as concrete aggregate are described in detail. Representative formulas are given, and the desired specifications for satisfactory aggregate of this type are discussed. The uses of these aggregates in concrete are briefly described.

4:20–5:30 P.M.

32. Business Session

PROPOSED SYMPOSIUM ON BODY PREPARATION

Contributions to this Symposium will be received during 1936 and will constitute the Summer Meeting Program of the White Wares Division

(1) Physical and chemical properties of body materials; specifications governing their purchase; their origin and mining.

(2) Chemical composition of the water and its effect.

(3) Effect of the soluble salts from clay on the dispersion process.

(4) Ball-milling *vs.* blunging.

(5) Moisture determination and correction.

(6) Types of blungers; power consumption.

(7) Preliminary disintegration of the clays.

(8) Weighing *vs.* volume measurement in batch preparation.

(9) Best types of scales and weighing machines.

(10) Control of the body slip by determination of density and fluidity; value of p_H determination and possible use of dispersing agents.

(11) Aging of slip.

(12) Variations due to use of casting scrap.

(13) Lawns and screens.

(14) Magnetic separators.

(15) Pumping: use of centrifugal, plunger, and diaphragm pumps, compressed air, and combination systems; power consumption.

(16) Pipe material: sizes and bends; corrosion and plugging.

(17) De-airing of slip.

(18) Filter-pressing methods: periodic and continuous filter presses.

(19) Treatment of filter-press plates by painting, enameling, metallizing, and galvanizing.

(20) Filter-press sacks and their treatment.

(21) Aging of body.

(22) De-airing of body.

(23) Effect of temperature in the several processes.

(24) Pugging by horizontal, vertical, and de-airing pug mills; general design of pug mills; possible use of kneading machines.

(25) Pug-mill nozzles: straight, right-angle, lubricated, rubber-lined; possible adaptation of electrolubrication.

(26) Comparison between the English slop or wet method of slip preparation and the American dry system; possible combination of the two.

(27) Methods of body storage and aging cellars.

(28) Means of maintaining constant water content in press cakes and pugged clay.

(29) Small bat-making pug mills.

(30) Control of consistency of pugged body.

(31) Means of combating dust in every part of the body preparation.

(32) Questionnaire on actual conditions and methods in the body-making departments of whiteware plants.

CREATIVE EXPRESSION THROUGH CERAMIC ART

Mabel C. Brady to Lecture Monday Morning

On the General Session Program of the Annual Meeting, Monday morning, March 30, the Society has been particularly fortunate in obtaining two speakers who *live* their work. Lawrence Saint's lecture on "Is Stained Glass a Lost Art?" is a subject which entirely absorbs Mr. Saint's life and to no less degree does Mabel C. Brady, Chairman of the Department of Ceramics, Haaren High School, New York City, impart richly of her experience and enthusiasm in teaching creative ceramics. Just as a communication[1] written by himself reveals Mr. Saint's capability and enthusiasm in his subject, so does the following candid letter from Mrs. Brady betray a contagious zeal. Note particularly her final paragraph in which she says, "plan anything for me that you wish—give me a soap box on Columbus' busiest corner and I will talk, sing, or dance clay for you. That is just how highly I regard my work."

On February 21, Mrs. Brady writes as follows:

"My training has been so varied, so peculiar, so lacking in system that it is extremely difficult to write, for I flitted from place to place where I could squeeze out just what was valuable to me.

"My academic education and the beginning of my art training were gotten in the State Normal School in Cortland, the town in which I lived. On graduation, I came to New York to teach and, while teaching, to prepare for what I hoped—an art career.

"Cooper Union, Pratt Institute, the Art League, Parsons School of Fine and Applied Arts, Columbia University, New York University, and Hunter College have all given me a great deal, which, with many summers in Europe both for travel and study, constitutes my training. My modeling was done as a pastime, a leisure-time hobby, chiefly with private instructors.

Mabel C. Brady

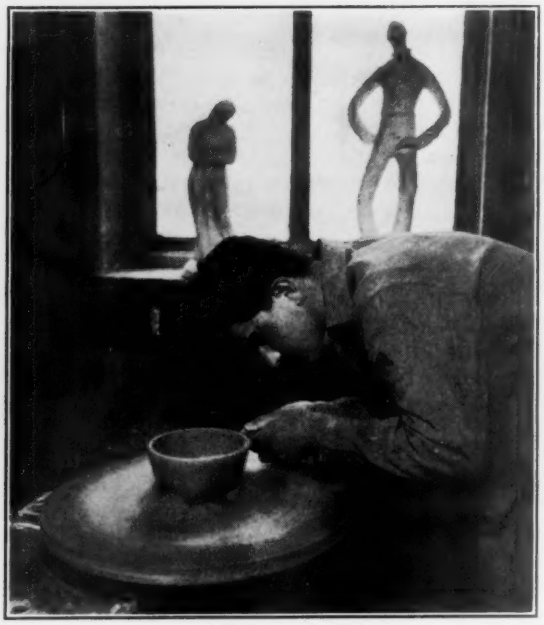
"Long before I had taken up pottery I had become intensely interested in the subject and had collected native ware in Europe and Northern Africa, besides some extremely fine Chinese ceramics.

"While teaching art in the New York schools, I found myself in need of a sedative, something to soothe frazzled nerves and relax a tired body. Knowing the delight of handling clay, I looked about for a place in which to work with pottery. I found Greenwich House—a large settlement house with a fine ceramic department. For eight years I worked there in all of my spare time. During that time I was made one of the art supervisors, appointed to a district of twenty-three schools with about eight hundred teachers.

"For a year or more I struggled to put over 'Art,' pitying the teachers with their manifold problems and sympathizing deeply with what they called their 'problem cases.'

"As an experiment I carried with me into several schools boxes of clay—trying out the so-called 'bad eggs' in pottery and modeling. The almost instant reaction to clay taught *me* something and I went from school to school saying 'give your problem boys some clay and they will become lambs.' There is something soothing in clay to high

[1] See *Bull. Amer. Ceram. Soc.*, **15** [2] 62 (1936).



Student at the wheel.

strung, temperamentally maladjusted, misunderstood boys; they beam when they have created something. I, too, was learning something valuable. Their efforts nearly always contained some fine art quality no matter how crudely modeled.

"For five years I begged various progressive principals who stood for creative expression to let me introduce clay work—but—but—but all the 'buts' I heard; the expense and the displeasure of the custodian if the floors were dirty were the most frequent excuses.

"I was working constantly at pottery and modeling, more and more convinced that clay is the finest medium for free expression. At that time there was no hope of introducing it into the lower grades and junior high schools.

"I decided to give up supervisory work if I could find a senior high school with a principal having enough vision to allow the work to be developed as it should be. I found such a principal in R. Wesley Burnham of Haaren High School, a school which had been recently remodeled. The Art Department Chairman had selected a room and some modeling had been done the year before.

"In September, 1930, I went to Haaren with high hopes, knowing the understanding principal and very sympathetic art chairman who had introduced the work the previous year. There was a room, desks, sink, and a box for clay—nothing else. It was for me to prove the value. Nothing but dogged determination carried me through the first years.

"As I had hoped, the authorities were convinced of the value of the work and in 1933 I received an electric kiln. Potters' wheels and other necessary equipment have been added gradually. Without equipment and with all the difficulties, the work has been a joy and stimulation every minute.

Work of students under the direction of Mabel C. Brady.

"My students have been art major students (the course is one of their requirements), problem cases, mental cases, sight conservation, and moral cases. In five and one-half years not more than a dozen boys have been dropped at my request or because they did not like the work. The work is growing; my classes are filled with students who 'elect' the work.

"Haaren is the only high school offering a full four-year course in ceramics as a regular art subject. The superintendents, even the most pedagogical, are impressed with the results *other than art*, while those in charge of art are convinced of its value. Nearly all of the high schools are now making an effort to have kilns installed, and I am turning my efforts to help them.

"The defense for this work in high schools will travel

Class in pottery, Haaren High School, New York, N. Y. "Three-ring circus" in pottery, modeling, and glazing.

with me to Columbus as it did to Syracuse,[2] except that in Columbus I shall have a larger and better exhibition.

"If I can do anything for the art teachers or student body while I am in Columbus do let me help. I feel that what I have lived through and what can be accomplished may take the fear out of beginning such work.

"My official position is Chairman of the Department of Ceramics, Haaren High School. In addition, I am Instructor in Pottery, College of the City of N. Y., School of Education; Instructor in Pottery and Modeling, Brooklyn Teachers' Institute; Extension Instructor in Modeling, School Art League Class for Talented Children.

"For five years, until October 1, 1935, I was the Director of Ceramic Center. I am a member of the New York Ceramic Society, Keramic Society, and Design Guild and exhibit with these organizations. I am looking forward to becoming a member of the American Ceramic Society.

"The Board of Education is sending me their official photographer the second week in March for new photographs of work which I shall have made into lantern slides as I have done before.

"I can not tell you how thrilled I am at the prospect of coming to Columbus.

"Be sure you put a definite time for me to speak, for without an automatic shut off I am apt to go on and on and on, getting up near cone 20.

"Plan anything for me to do that you wish—give me a soap box on Columbus' busiest corner and I will talk, sing, or dance clay for you. This is just how highly I regard the work."

Helping stock a kiln.

127 West 58th Street
New York, N. Y.

[2] Mrs. Brady took part in the program of the Fall Meeting of the Art Division of the American Ceramic Society, held in Syracuse, N. Y., October 25 and 26, 1935.

CERAMIC EXHIBIT AT ART GALLERY

In connection with the Annual Meeting of the American Ceramic Society, an exhibit of ceramics has been planned for display at the Columbus Gallery of Fine Arts beginning March 22.

From local sources a Committee is assembling interesting ware of the past and present which will be shown under three general classifications.

(1) Fine ceramics of the past will be represented by the Gallery's own Howald Collection of Italian and Near Eastern pottery, supplemented by examples of other types and periods which will be loaned by their owners for the occasion.

(2) The work of contemporary pottery craftsmen of Columbus will be shown in another group. During recent years a widespread interest in pottery making has developed in this city. As a part of the coming exhibition the public will be interested to see the progress which is being made by a large number of local potters who have been working in connection with several centers of production and instruction. In the Ceramic Art Division of the Fine Arts Department at the University, in the Columbus Art School, in the studios of Miss May Cook, Andrew Pereny, and others, creditable work has been done in which Columbus may take pride.

(3) The third division of the exhibit will be devoted to current American tableware. Through the kindness of local dealers, table settings will be displayed which will illustrate some of the progressive developments which are being made by American manufacturers in this field.

Members of the Exhibition Committee are Arthur E. Baggs, *Chairman;* Mrs. Edward Orton, Jr., Miss May Cook, Philip R. Adams, George A. Bole, Chester Nicodemus, Ralph Trivella, Felix Payant, Carlton Atherton, Edgar Littlefield, F. B. Hobart, and H. E. Simpson.

GOLF TOURNAMENT

A golf tournament will be held at 1:30 P.M. Friday, April 3, at the Columbus Country Club unless weather conditions have made the course unplayable. This 18-hole course is one of the most beautiful and sporty courses in the Mid-West. The Club is located on East Broad Street, seven miles east of the Deshler-Wallick Hotel.

The tournament will be a blind bogey affair, so that all may have an opportunity to win. Green fees are $1.50. Members desiring to play are asked to register for the Tournament at the Society Registration Desk at the Deshler-Wallick Hotel.

A. E. BAGGS TO LECTURE DURING ANNUAL MEETING

Arthur E. Baggs, Professor of Fine Arts, in charge of Ceramic Art at Ohio State University since 1928, will give a lecture and demonstration on pottery making at the Columbus Gallery of Fine Arts during the Annual Meeting. Professor Baggs possesses that rare ability of creating and expressing his ideas in beautiful figures of clay, and those who attend his lecture are assured an interesting and instructive hour.

Born in Alfred, N. Y., he obtained his early education at the N. Y. State College of Ceramics. He attended the Art Students' League of New York City for two years and later took lecture courses in design under Dr. Denman Ross, Harvard University. While in New York City, he was instructor at the Ethical Culture School and also part-time instructor in ceramics at the School of Design and Liberal Arts.

From 1925 to 1928 he was associate ceramist with R. Guy Cowan, Cowan Pottery Studio, Rocky River, Ohio, and in 1927–28 he was Master in Ceramics at the Cleveland School of Art. In addition he has maintained and directed his own pottery (Marblehead Potteries), Marblehead, Mass.

Professor Baggs has been the recipient of many honors: Honorable Mention, Boston Society of Arts and Crafts, Special Exhibition, Copley Hall, Boston, 1907; Mrs. J. Ogden Armour Prize for Pottery, Chicago Art Institute, 1915; Boston Arts and Crafts Society Medal, 1925; Charles F. Binns Medal, 1928; First Prize, Pottery, Cleveland Museum of Art Annual Exhibition in 1928. His work is also represented in permanent collections at the Metropolitan Museum, N. Y., Museum of Fine Arts, Boston, Mass., and Newark Art Museum, Newark, N. J.

A. E. Baggs

EXHIBIT OF AMERICAN TABLEWARE AND WATTS LECTURE

The Department of Ceramic Engineering at Ohio State University has maintained for a number of years an elaborate and complete display of American vitreous and semi-vitreous china at Lord Hall on the Campus.

Arthur S. Watts, Chairman of the Department of Ceramic Engineering, who has charge of this exhibit has recently communicated with every manufacturer of tableware in the United States, inviting them to bring this exhibit up to date by supplying specimens of their most attractive and important designs and decoration offered for 1936 markets. The chinaware received has been assembled and placed in large glass exhibit cases with needed information regarding each specimen. This exhibit will be moved to the Neil House Mezzanine Floor during the Meeting and Professor Watts will present the subject of "Tableware for the Home" in an address before the ladies attending the Meeting. This talk is scheduled for Tuesday forenoon at 11 o'clock.

All other persons interested are cordially invited to attend this lecture and to inspect the exhibit which will be on display permanently at Lord Hall following the Meeting.

OHIO STATE UNIVERSITY ALUMNI DINNER

The annual dinner meeting of the Ohio State University Alumni will be held Tuesday evening, March 31, 5:45 P.M. at the University Club, 40 South Third Street, Columbus, Ohio. The Club is only a short distance from the Deshler-Wallick Hotel.

Francis Schmidt, football coach, Ohio State University, is scheduled as speaker and several reels of moving picture films of the 1935 football games will be shown. All Ohio State Alumni are urged to be present.

The price of the dinner will be $1.25 per person. Tickets can be obtained at the Registration Desk at the Society Headquarters in the Deshler-Wallick Hotel. All alumni planning to attend are urged to register for the dinner as early as possible in order that adequate arrangements can be made. The meeting will be over by 8:00 P.M. so that all may return to the hotel to hear W. J. McCaughey's lecture.

ACTIVITIES OF THE SOCIETY

AMERICAN CERAMIC SOCIETY CONSTITUTION AND BY-LAWS

The Constitution and By-Laws of the American Ceramic Society grew rather slowly over a period of years and for a long time satisfied most of the situations which developed. It has been found recently, however, that they are not in strict accord with the Ohio State laws for such corporations as ours and as such should be amended or changed to conform.

We have found, also, that the Constitution and By-Laws as they have been developed with amendments have created conflicts of wording such that it is difficult at times to find out exactly what they mean. Further amendment on such contradictory phrases is as difficult as the present interpretation, so it appears that simplification is better.

The Constitution and By-Laws have not heretofore been clear, because only sections of them have been looked at for any particular situation. They have now been brought together, which shows even more than we had suspected the necessity of clarifying the language for our own use as well as of making it conform to the state laws.

Therefore, a Committee has been appointed by the Board for the purpose of rewriting the Constitution and By-Laws, solely with the idea of so wording it and simplifying it that it will tell the story of what we are doing, or are endeavoring to do, under the present Constitution and without any idea whatever of making any major changes that would affect the present set-up. There is no thought of making a "new deal" for the American Ceramic Society or of taking advantage of the situation for the development of any "pet" ideas.

The Board and Rules Committee, which have had the job of interpreting for the members the meaning and thought of the Constitution and By-Laws, are anxious to get the document in such shape that there will not be a constant searching for the real meaning behind the making of the Constitution and the well-being of the Society. The original is so long and involved that it would take more pages than it would be worth to publish in *The Bulletin*.

We hope the new one can be so clearly stated that it can be adequately published and the interpretation will be so obvious that it will not call for frequent clarification of obtuse and conflicting statements.

The Board will welcome any suggestions that can help out this plan, although it must be remembered in making suggestions that the whole thought behind the rewriting is *not* to change the present set-up. That is something that should be voted on separately by the members, if they desire it. —F. C. FLINT, *Vice-President*

RULING ON INCOME TAX ON DUES PAID

The following communication has been received by the Secretary of the American Ceramic Society from Charles T. Russell, Deputy Commissioner of the Treasury Department, Washington, D. C., defining the status of the Society in connection with the federal income tax; the letter was written February 18, 1936.

Reference is made to the evidence submitted by you for use in determining your status for the purpose of Federal Income Taxation. Exemption is claimed under section 101 (6) of the Revenue Act of 1934.

The evidence discloses that you were incorporated in 1905 under the General Corporation Laws of the State of Ohio, for the promotion of the arts and sciences connected with ceramics by means of meetings, for social intercourse, for the reading and discussion of professional papers, and for the publication of professional literature.

Your By-Laws provide that your Society shall consist of Honorary Members, Ex-Officio Honorary Members, Fellows, Active Members, Life Members, Associate Members, Corporation Members, Life Corporation Members, and Industrial Association Members, and that your affairs shall be managed by a Board of Trustees, consisting of a President, Vice-President, Treasurer, the two most recent Past-Presidents, and a Trustee Representative of each of your Divisions.

It is stated that you hold one Annual Meeting, summer meetings by Divisions, Local Sections Meetings, and Student Branch Meetings, all for the purpose of discussing scientific and technical matters pertaining to ceramics and the ceramic industry; that such meetings are addressed by speakers prominent in the arts and sciences connected with ceramics; and that your Society issues three monthly publications, namely, *Journal of the American Ceramic Society, The Bulletin of the American Ceramic Society*, and *Ceramic Abstracts*. The November, 1935, issue of the *Journal of the American Ceramic Society* contains research reports, such as "Kinetics of Solid-Phase Reactions of Certain Carbonates with Mullite, Silica, and Alumina," "The Determination of Alkalis in Silicates with Special Reference to High-Alumina Refractories," "The International Standardization of Colors," etc.

The Bulletin of the American Ceramic Society is devoted to proceedings of your Society, discussions of plant problems, technical, scientific, and art questions, and promotion of coöperative research, and contains editorials, papers and discussions, bibliography of bibliographies, etc. The *Ceramic Abstracts* is devoted to the arts and sciences related to silicate industries. These abstracts are the result of original researches compiled by your Secretary-Editor, and are distributed to your members. The abstracts relate to abrasives, art and archeology, cements, enamel, glass, clay, refractories, terra cotta, etc.

Under your direction groups of students from the ceramic departments of various universities are organized into Student Branches of your Society, and you publish and furnish to these Branches, without cost, certain printed matter. Nonmembers are furnished, without cost, technical information connected with ceramics and the ceramic industry.

Your financial statement discloses income derived principally from personal and corporation dues, advertisements, and subscriptions, and expended for salaries, publications, and other operating expenses. There is no

capital stock. None of your income is credited to surplus or may inure to the benefit of any private shareholder or individual.

Based upon the facts presented, it is held that you are entitled to exemption under the provisions of section 101(6) of the Revenue Act of 1934 and the corresponding provisions of prior revenue acts. You are not, therefore, required to file returns for 1934 and prior years. Future returns will not be required so long as there is no change in your organization, your purposes, or method of operation.

Any changes in your form of organization or method of operation, as shown by the evidence submitted, must be immediately reported to the Collector of Internal Revenue for your District in order that the effect of such changes upon your present exempt status may be determined.

The exemption granted in this letter does not apply to taxes levied under other titles or provisions of the respective revenue acts, except insofar as exemption is granted expressly under those provisions to organizations enumerated in section 101 of the Revenue Act of 1934 and the corresponding provisions of prior revenue acts.

Contributions to your organization by individual donors are deductible by such individuals in arriving at their taxable net income in the manner and to the extent provided by section 23(0) of the Revenue Act of 1934 and the corresponding provisions of prior revenue acts. The deductibility of contributions by corporations is governed by sections 102 and 107 of the Revenue Act of 1935.

A copy of this letter is being transmitted to the Collector of Internal Revenue for your District.

By direction of the Commissioner.

Respectfully,
CHAS. T. RUSSELL, *Deputy Commissioner*

AUDIT REPORT OF THE AMERICAN CERAMIC SOCIETY FOR 1935

ASSETS			
Cash in Bank (inc. Fellow account)		$6,550.08	
Cash in Revolving Fund		300.00	
Petty Cash in Office		5.00	$ 6,855.08
Liberty Bonds ($2000 First 4¼%—Called)		2,057.49	
U. S. Treasury Bonds, 3⅜% (200)		199.74	
U. S. Treasury Bonds, 4¼% (200)		209.42	
Savings Account (Buckeye State Bldg. & Loan)		709.66	3,176.31
Accounts Receivable		1,657.18	
Accrued Interest		64.83	1,722.01
TOTAL ASSETS			11,753.40
LIABILITIES			
Accounts Payable			
Reserve for Fellow Dues		2,307.71	
Deferred Income: (Prepaid)			
Corporation Dues	$1,800.00		
Personal Dues	4,463.28		
Journal Subscriptions	933.65	7,196.93	
TOTAL LIABILITIES (or Deferred items)			9,504.64
SURPLUS (Assets over Liabilities)			2,248.76

INCOME	1935 PUBLICATION	GENERAL
Dues—Corporation	$ 1,122.00	$ 3,556.93
—Personal	7,488.00	8,657.30
Divisions		
	8,610.00	12,214.23
INCOME (*continued*)		
Journals—Current Year	5,020.27	
—Previous Years	858.30	
	5,878.57	
Advertising	8,506.71	
Miscellaneous	163.00	22.34
Fellow Account		
Reprints (Net)	124.90	
Annual Meeting		460.16
Contributions		5.00
Interest		81.26
	8,794.61	568.76
TOTAL INCOME	23,283.18	12,782.99
EXPENSES		
Cost of Publication	13,488.22	
Abstracts	666.94	
Reprints (Net)		
Editor's Office Expense	1,008.44	
	15,163.60	
Salaries	7,892.50	5,228.26
Secretary's Office Expense	.....	1,256.94
Postage	500.00	1,047.23
Office Rent	480.00	480.00
Annual Meeting		
Divisional Expenses		196.02
Miscellaneous	34.72	110.91
	8,907.22	8,319.36
Write-offs:		
Office Equipment	82.50	1,525.32
Bad Accounts		
Publications		1,827.95
	82.50	3,353.27
TOTAL EXPENSES, ETC.	24,153.32	11,672.63
Gain or (Loss)	(870.14)	1,110.36

GEORGE H. BROWN

George H. Brown, Trustee Representative nominee for the Materials and Equipment Division, was born at Miamisburg, Ohio, May 18, 1884. He was graduated from the Department of Ceramics, Ohio State University, in 1908 and in 1933 was awarded the degree of Ceramic Engineer from the same University.

From 1909 to 1916, Professor Brown was Assistant Ceramic Chemist in the Ceramic Laboratory of the Bureau of Standards, Pittsburgh, Pa. Since 1916 he has been Director of the Department of Ceramics and Professor of Ceramics, Rutgers University, New Brunswick, N.J.

He has been a member of the American Ceramic Society since 1908. From 1914 to 1917, he served as a Trustee of the Society and was elected President for 1917–1918. He is a Fellow of the American Ceramic Society.

From 1916 to the present time, Professor Brown has been Secretary of the Ceramic Association of New Jersey (formerly the New Jersey Clay Workers' Association); since 1928 he has been Consulting Ceramic Engineer for the Port of New York Authority.

Professor Brown is also a member of Phi Beta Kappa, Sigma Xi, Phi Lambda Upsilon, and Keramos.

George H. Brown

John L. Carruthers

JOHN L. CARRUTHERS

John L. Carruthers, Trustee nominee of the Terra Cotta Division, was born in Lafayette, Colo., July 25, 1895. He was graduated from the North Side High School in Denver, Colo., in 1913, and attended Ohio State University during the years 1914–1915, 1917–1918, and 1919–1921, receiving the degree of B.Cer.E., in 1921. In 1934, he received a degree of Ceramic Engineer from Ohio State University. He is a registered Ceramic and Structural Engineer in the State of Ohio.

During 1913–1914, Professor Carruthers worked for the Pullman Co. in Denver, Colo.; from 1915 to 1917 he was plant engineer with the Denver Terra Cotta Co., and ceramic engineer for this Company during 1921 and 1922. From 1923–1925, he was employed with the Harrop Ceramic Service Co., erecting, designing, and servicing tunnel-kiln installations in various parts of the United States. In 1925 he became a member of the Staff of the Department of Ceramic Engineering at Ohio State University, as Assistant Professor until 1930 and from 1930 to the present time as Associate Professor. Professor Carruthers served in the United States Air Service during the World War.

Professor Carruthers joined the American Ceramic Society in 1922, became an Active Member in 1924, and

in 1933 was elected a Fellow of the Society. He served as Chairman of the Structural Clay Products Division in 1934–1935, and Chairman of the Terra Cotta Division, 1935–1936. He has a faithful record of service on the Program, Division Editorial, and other Division committees.

In addition to the American Ceramic Society, he is a member of the Society for the Promotion of Engineering Education, Sigma Xi, Keramos, and Sigma Gamma Epsilon.

Among the research papers which Professor Carruthers has published since 1922 are the following from the *Journal of the American Ceramic Society:*

(1) "Notes on Shivering of Terra Cotta," **5** [8] 518 (1922).
(2) "Use of Forced Draft for Terra Cotta Kilns," **5** [7] 449 (1922).
(3) "Drier Problems with Calculations," **14** [1] 8 (1931).
(4) "Laboratory Test Kilns," (with A. S. Watts), **15** [2] 154 (1932).
(5) "Loading Device for Load-Test Furnace," **19** [2] 36 (1936).

Other publications are as follows:

(6) "Economies of the Car-Tunnel Kiln," *Bull. Amer. Ceram. Soc.*, **4** [12] 668 (1925).
(7) "Drying Problems of the Ceramic Industry," *Trans. Amer. Soc. Mech. Engrs.*, **57**, 439 (1935).

J. LEO CHILD

J. Leo Child of the Hancock Brick & Tile Company, Findlay, Ohio, has been nominated for the office of Trustee Representative for the Structural Clay Products Division of the Society. Mr. Child has been affiliated in membership with this Society since 1907.

After completing his high school education, Mr. Child spent three years at Ohio State University. His work has been almost entirely in the field of sales financing and administrative problems and he has been connected with several different corporations in the capacity of director and an official. Mr. Child writes of himself as follows: "I do not have a technical mind, and I have always resorted to hiring engineers when needed."

J. Leo Child

ROSTER CHANGES DURING FEBRUARY*

Personal

BOWMAN, RALPH M., Republic Steel Corp., Republic Bldg., Cleveland, Ohio. (Youngstown, Ohio)
FOGELBERG, SVEN, Webb's Crystal Glass Co., Dennis Glassworks, Stourbridge, England. (Strand, London W. C. 2)
JONES, FRANK L., Mellon Institute, Pittsburgh, Pa. (Rochester, N. Y.)
LINDBERG, AUGUST G. R., JR., 501 Christie St., Ottawa, Ill. (Chicago, Ill.)
MATTYASOVSZKY-ZSOLNAY, LASZLO, Zsolnay Works, Budapest, Hungary. (Pecs, Hungary)
NEWHOUSE, HENRY, Y. M. C. A., Washington, D. C. (Columbus, Ohio)
OFFUTT, JAMES S., 439 Ridge Ave., Evanston, Ill. (Columbus, Ohio)
SAULS, J. BEVERLEY, R. J. Funkhouser & Co., Inc., Hagerstown, Md. (Baltimore, Md.)
SLAVEN, S. J., Mullite Refractories Co., Shelton, Conn. (Seymour, Conn.)
SPENCE, C. FRANKLIN, 1631 E. 93rd St., Cleveland, Ohio. (Columbus, Ohio)
WALL, MRS. GERTRUDE R., 5506 Telegraph Ave., Oakland, Calif. (Berkeley, Calif.)
WATSON, WILLIAM, c/o Martin, P. O. Box 2933, Johannesburg, South Africa. (Near Linlithgow, Scotland.)
WEHTJE, KARL FREDRIK, A/B Rörstrands Porslinsfabriker, Lidköpings Porslinsfabrik, Lidköping, Sweden. (Gothenburg, Sweden)
WOODHOUSE, CHARLES D., Box 117, Laws, Inyo County, Calif. (Mocalno, Mono County, Calif.)

MEMBERSHIP WORKERS' RECORD†

Corporation		A. E. J. Vickers	1
Office	3	Office	4
Personal		**Student**	
W. M. Cohn	1	C. M. Dodd	2
C. M. Dodd	1	J. F. Herold	1
G. J. Easter	1	M. E. Holmes	1
Donald Hagar	1	R. K. Hursh	2
F. A. McCann	1	F. H. Norton	2
W. H. Pfeiffer	1	N. W. Taylor	1
J. T. Robson	1	C. L. Thompson	1
Alexander Silverman	1	Office	1
R. B. Sosman	1		
W. A. Weldon	1	**Grand Total**	29

* Address in parentheses is the old address.
† See p. 104 for "New Members."

NEW MEMBERS

Corporation

BLYTHE COLOUR WORKS LTD., Cresswell, Stoke-on-Trent, England.
BROWN INSTRUMENT CO., A. E. Krogh, voter, Philadelphia, Pa.
SAFETY GRINDING WHEEL & MACHINE CO., E. D. Vance, voter, Wheel & Larch Sts., Springfield, Ohio.

Personal

ANDEREGG, FREDERICK O., Owens-Illinois Glass Co., Newark, Ohio; consulting specialist on building materials.
ARNOLD, CHESTER L., 199 Ninth St., Monaca, Pa.; glass technologist, Phoenix Glass Co.
CHASE, BYRON L., Box 574, Avalon, Calif.; ceramic engineer, Catalina Clay Products.
COLLINS, WILLIAM G., 213 Dorchester Court, Waukegan, Ill.; development engineer, Johns-Manville Corp.
CRUIKSHANK, CHARLES L., 720 United Artists Bldg., Detroit, Mich.; manager, ceramic department, Great Lakes Foundry Sand Co.
MAYS, GEORGE A., Niles, Calif.; superintendent and general manager, California Pottery Co.
MEACHAM, F. L., Frigidaire Division of General Motors Corp., Dayton, Ohio; manager, materials and process engineering division.
MOULD, WILLIS P., Johnson, Vt.; superintendent, Eastern Magnesia Talc Co.
NEW, GEORGE F., British Titan Products Co., Ltd., Billingham, Stockton-on-Tees, England; departmental manager.
PIERCE, ROBERT H. H., JR., Engineering Experiment Station, Ohio State University, Columbus, Ohio; Research Laboratory, U. S. Steel Corp., Kearny, N. J.
RYDER, THOMAS E., Hershey Community Club, Hershey, Pa.; instructor of arts and crafts.
SWENTZEL, JOHN P., 3801 Buffalo Ave., Niagara Falls, N. Y.; refractories research engineer, Carborundum Co.
THIOLY, ERNEST, Alvarado 1146, Buenos Aires, Republic of Argentina.
TURBETT, FORREST L., Eagle Picher Lead Co., Joplin, Mo.; research chemist.
WISS, J. E., 1976 N. Fourth St., Columbus, Ohio; industrial service, U. S. Gypsum Co.

Student

CONNELLY, DANIEL S., Ohio State University.
DAY, ROBERT B., University of Illinois.
EKUMER, ROBERT, Alfred University.
FILIPPI, CHARLES R., University of Illinois.
GREEN, MICHAEL E., Missouri School of Mines.
HYDE, COLLIN, Ohio State University.
KING, BURNHAM W., JR., University of Illinois.
LUKENS, ALAN R., Massachusetts Institute of Technology.
MOHR, JOHN G., Pennsylvania State College.
TYRRELL, MILES E., Missouri School of Mines.
VANDERPOOL, JAMES W., Massachusetts Institute of Technology.

OUR ANNUAL TURNOVER

Resignations follow the issuance of due bills. In years past it was not unusual to lose 200 persons by such resignations. This year our "resigners" total 27 personals and 4 Corporations and yet our net gain for the month is 10, a turnover in the black and to the right.

There is also a decrease in the "deferred- and part-payment" members.

Shall this coöperative educational enterprise be able to meet the opportunities of 1936 which already loom larger than those of 1935? More member-supporters is the pledge in this unanimous affirmative answer.

MEMBERSHIP STATUS

	January 31	February 29
Paid in Full		
Personal	1276	1273
Corporation	187	186
Honorary, Life, and Complimentary	26	26
Deferred Personal	24	22
Part-Payment Personal	42	39
Subscribers	491	496
Advertisers	39	53
Current Sales	225	225
Total	**2310**	**2320**

CERAMIC WARE PRIZES TO BE GIVEN TO LADIES

The Ohio Ceramic Industries Association is acting as sponsor of the prizes to be given to ladies who are registered attendants at the Columbus Meeting. The drawing for these prizes will be held at the dance Wednesday evening, April 1, in the Ball Room of the Neil House. The list of prizes and their respective donors are as follows:

(1) Four-color luncheon set ("Fiesta" design by F. H. Rhead): Homer Laughlin China Co., Newell, W. Va.
(2) Willow console bowl and candlesticks: S. A. Weller Co., Zanesville, Ohio.
(3) 53-piece dinner set (beautifully decorated in brown and orange): Crooksville China Co., Crooksville, Ohio.
(4) Chop dish (decorated by Gale Turnbull): Sebring Pottery Co., Sebring, Ohio.
(5) Modern console bowl and candlesticks: Edwin M. Knowles China Co., East Liverpool, Ohio.
(6) 32-piece Rose Point breakfast set: Pope-Gosser China Co., Coshocton, Ohio.
(7) 36-piece yellow Petit Point breakfast set (designed by Walter Ford): W. S. George Pottery Co., East Palestine, Ohio.
(8) Claycraft pottery (designed by Arthur E. Baggs): The Claycraft Co., Columbus, Ohio.
(9) Breakfast set, service for six (beautifully decorated in blue and silver): Taylor, Smith & Taylor Co., East Liverpool, Ohio.

ANNUAL REPORTS OF SOCIETY COMMITTEES

COMMITTEE ON EDUCATION

Aims

In taking up the work of the Committee on Education, this Committee looked about for the best field for its endeavors. Last year Dr. Bleininger did some work on a Syllabus of the Ceramic Industry. Continuation of this work was considered and discussed with Dr. Bleininger. Another suggestion was that some provision be made in the ceramic schools for graduate study work away from the university for which university credit could be given. After discussion with various heads of ceramic departments, it was decided that this was too impractical to attempt.

The fostering of the publication of textbooks on the subjects where there is a deficiency of good textbooks was considered and it is understood that the Refractories Division Education Committee is coöperating with the American Refractories Institute on a new book on refractories.

The final program decided upon was to review the present books now available for the purpose of prescribing a program of reference reading for men with fundamental ceramic education so that when they have mastered such assignments and brought their knowledge up to date they can keep up to date by following the technical literature.

This last program, suggested by A. S. Watts of Ohio State University, seems to fit in with some work previously attempted by this Committee in former years.

Reference Reading List

Various members of the Committee have sent in lists of books pertaining to their Division work from time to time, and this list has been correlated by the Chairman under the following subheads:

(1) General Ceramics

Ceramics–Clay Technology by Hewitt Wilson.
Ceramic Products Cyclopedia.
A.S.T.M. Standards and Tentative Standards.
Treatise on Ceramic Industries by Bourry.
Writings of Hermann Seger (2 vols.).
Fundamentals and Economies in the Clay Industries by Ellis Lovejoy.
Ceramic Tests and Calculations by A. I. Andrews.

(2) General Chemistry

Handbook of Non-Ferrous Metallurgy by Liddell.
Soluble Silicates in Industry by J. G. Vail.
Principles of Chemical Engineering by Walker, Lewis, and McAdams.
Elements of Chemical Engineering by Badger and McCabe.
Chemical Analysis of Special Steels, Steel-Making Alloys, and Graphite by Johnson.

(3) Physical Chemistry

States of Aggregation by Tammann Mehl.
Hall-Insley Diagrams, *Jour. Amer. Ceram. Soc.*, **16** [10] 455–568 (1933).
Writings of Hermann Seger (2 vols.).
Outline of Physical Chemistry by Getman and Daniels.
International Critical Tables.
Die Silikatschmelzlosungen (Vols. I and II) by J. H. L. Vogt.
The Collected Works of J. Willard Gibbs.
Data on Geochemistry by F. W. Clarke, *U. S. Geol. Surv. Bull.*, No. 770.
Silica by R. B. Sosman.

(4) Colloid Chemistry

Colloids by Kruyt.
Colloid Symposium (Monograph Vol. II), edited by H. N. Holmes.
Colloid and Capillary Chemistry by Freundlich.
Applied Colloid Chemistry by W. D. Bancroft.
Chemistry of the Colloidal State by Ware.

(5) Geology

Clays–Occurrence, Properties, and Uses by H. Ries.
Elements of Engineering Geology by H. Ries and Watson.
Data on Geochemistry by F. W. Clarke, *U. S. Geol. Surv. Bull.*, No. 770.
The Origin of the Igneous Rocks by Bowen.

(6) Mineralogy and Petrography

Petrographic Methods for Soil Laboratories by W. H. Fry.
Dana's Manual of Mineralogy.
Microscopic Determination of the Non-Opaque Minerals by E. S. Larsen and H. Berman, *U. S. Geol. Surv. Bull.*, No. 848.
Gründlagen der Physikalisch; Chemischen Petrographie by H. E. Boeke and W. Eitel.
Microscopic Determination of the Ore Minerals by M. N. Short.
Defects in Glass by C. J. Peddle.
The Principles of Petrology by Tyrrell.
Elements of Optical Mineralogy by A. N. Winchell; Vol. I, Principles and Methods; Vol. II, Description of Minerals; and Vol. III, Determinative Tables.
The Microscopic Characters of Artificial Minerals by A. N. Winchell.

(7) Kilns and Furnaces

Practical Industrial Furnace Design by M. A. Mawhinney.
Burning of Clay Wares by Ellis Lovejoy.
Problem in Firing Refractories, *U. S. Bur. Mines Bull.*
Fuels and Their Combustion by Haslam and Russell.
Industrial Furnaces by W. Trinks (2 vols.).
Flow of Gases in Furnaces by V. E. Groume-Grjimailo.

(8) Temperature Control

Pyrometry, *Bur. Stand. Tech. Bull.*, No. 170.
Pyrometry by Wood and Cork.

(9) Thermodynamics

Thermodynamics by Lewis and Randall.
International Critical Tables.

(10) Glass

Les Propriétés Physique et la Fusion du Verre by Long.
Defects in Glass by C. J. Peddle.
Electrical Properties of Glass by J. T. Littleton and G. W. Morey.
Glastechnische Tabellen by Pirani and Eitel.
Soluble Silicates in Industry by J. G. Vail.
Modern Glass Practice by S. R. Scholes.
Refractory Blocks for Glass Tank Furnaces by J. H. Partridge.

(11) Refractories

Refractories by F. H. Norton.
Refractory Materials, Their Manufacture and Use by A. B. Searle.
Problem in Firing Refractories, *U. S. Bur. Mines Bull.*
Silica by R. B. Sosman.
Clays–Occurrence, Properties, and Uses by H. Ries.

(12) Whiteware

Clays–Occurrence, Properties, and Uses by H. Ries.
Practical Book of Chinaware by Eberlein and Ramsdell.
English Pottery and Porcelain by W. E. Honey.
Early American Pottery and China by John Spargo
Porcelain: Its Nature, Art, and Manufacture by William Burton.

(13) Art

Early American Pottery and China by John Spargo.
Potter's Craft by C. F. Binns.
Porcelain Pagodas and Palaces of Jade by A. E. Grantham.
Ceramic Art in Great Britain by L. Jewitt.
Clays–Occurrence, Properties, and Uses by H. Ries.
Soluble Silicates in Industry by J. G. Vail.

(14) Enamel

Advanced Technique of Porcelain Enameling by J. T. Hansen.
Soluble Silicates in Industry by J. G. Vail.
Enamels for Sheet Iron and Steel by J. B. Shaw.
Materials and Methods Used in the Manufacture of Enameled Cast-Iron Wares by H. F. Staley.
Wet-Process Enamels for Cast Iron by R. R. Danielson.
Die Emailfabrikation by Stuckert and Ludwig.
Enamels by A. I. Andrews.

(15) Materials and Equipment

Ceramic Plant Design and Equipment by T. W. Garve.
Materials and Methods Used in the Manufacture of Enameled Cast-Iron Wares by H. F. Staley.
Clays–Occurrence, Properties, and Uses by H. Ries.
Soluble Silicates in Industry by J. G. Vail.
Fundamentals and Economies in the Clay Industries by Ellis Lovejoy.

(16) Structural Clay Products

Clays–Occurrence, Properties, and Uses by H. Ries.
Fundamentals and Economies in the Clay Industries by Ellis Lovejoy.
Burning of Clay Wares by Ellis Lovejoy.

It is fully realized that this list is incomplete and that the subheads under which the books are listed might be very well elaborated. It was also hoped to be able to add with this list of books, a review of each book so that anyone wishing to review on certain phases of ceramics could go to this list and pick out the books most applicable to his particular interests.

Some years ago a list of complete ceramic references was compiled by the Education Committee and this list was made available by R. C. Purdy. This Committee, however, did not plan any such pretentious scheme and hoped only to concentrate on the books which are at present up to date and the most complete and modern in their particular phase.

It is hoped that succeeding committees will use this start and complete the work.

Engineers' Council for Professional Development

Some correspondence was carried on with C. F. Hirshfeld, Chairman, Engineers' Council for Professional Development, in reference to the inclusion of the American Ceramic Society on their list of participating bodies.

At the present time, the crediting of engineering courses is done by a standing committee on engineering schools, on which there is no representative from the ceramic industry.

Karl T. Compton, Chairman of the Special Committee on Engineering Schools, outlined the stand of the Committee in a letter to the Chairman of this Committee. The substance of his remarks is that there is sufficient flexibility in the plan of the Engineers' Council for Professional Development to permit calling in extras in any special field, such as ceramics, to advise the Committee on technical points if advisable.

At the present time Ceramic Engineering is listed with Chemical Engineering.

This correspondence was turned over to A. S. Watts, Chairman of the Association of Ceramic Educators, and was also discussed with the heads of several departments of ceramics of our ceramic schools.

The general feeling is that we can not do more than protest the omission of the ceramic engineering profession from this organization and try to prove with time that it is unjust; furthermore, that the Engineers' Council for Professional Development is not qualified to evaluate work in ceramics, except in the strictly engineering aspects. Such protest has been formally lodged with Dr. Compton, Chairman of the Committee on Engineering Schools.

—H. E. WHITE, *Chairman*

STANDARDS COMMITTEE REPORT

The danger of conflict in the development of standards has resulted in an attempt to establish a working agreement with other national bodies in which ceramic terms and materials may be employed. The organizations include the American Chemical Society, American Institute of Physics, American Institute of Mining Engineers, American Society of Mechanical Engineers, American Society of Sanitary Engineers, American Society for Testing Materials, Society of Rheology, American Standards Association, and the National Bureau of Standards.

It is agreed that in the future all proposed standards will be submitted to the other interested organizations before action is taken.

The same situation developed in connection with the matters of definitions and standards. Subcommittee A (Definitions) announced on January 13, 1936, that the development of definitions by that Committee shall be limited to words which belong specifically in the field of ceramics or which have a special meaning in ceramics.

Based on this action, the list of minerals and physical terms with definitions submitted by the Refractories Division was referred back to the Data Committee of that Division for citation of sources of the definition submitted. The American Ceramic Society may thus endorse these definitions if it sees fit without assuming responsibility for their origin.

The list of symbols and abbreviations submitted by the same Division was referred by Subcommittee A (Definitions) to the American Standards Association, Section Z-10 (Letter Symbols and Abbreviations), which is the recognized clearing house for such material. The revision of the book, Manual of Good Practice for Brick Masonry, is in progress and the American Ceramic Society is invited to participate. This was referred to the Structural Clay Products Division.

The Standard Specification for Fine Sieves has been studied for three years by representatives of thirty-two national organizations, including the American Ceramic Society, in the hope that the former tolerances can be reduced and the screens be made more accurate. A report is now in preparation which the Committee hopes will be approved.

The Standards Committee has been solicited for cooperation in the development of two foreign books, (1) German-French-English Technical Dictionary by F. H. Zschacke of Berlin, Germany, and (2) Dictionary of Silicate Terminology by S. I. Perkal of Kharkov, U.S.S.R.

The manuscript for (1) was returned to the author, since its publication proved to be a private enterprise and the copy could not be deciphered. The Perkal book was found to contain such a large proportion of terms not essentially ceramic that it must be revised before it can be properly handled by this Society.

The proposed American standard for Traps for Plumbing, etc., was submitted to this Committee. This standard has been endorsed by the American Society of Sanitary Engineers and the American Society of Mechanical Engineers. The Standards Committee is divided on the policy involved, since the problem is not a ceramic one and may establish a precedent. If approved, the Standards Committee recommends that the Board of Trustees endorse the specifications sponsored by the A.S.S.E. and A.S.M.E., but that this standard not be made a standard of the American Ceramic Society.

—A. S. WATTS, *Chairman*

COMMITTEE ON PUBLICATIONS REPORT FOR 1935

Content of 1935 Publications

The Journal of the American Ceramic Society for 1935 contains 76 articles covering 400 pages of text. As articles are often of interest to several Divisions of the Society, it is difficult to subdivide them according to such interests. There are 5 papers distinctly in the whitewares class, 18 enamel papers, 13 glass papers, 28 papers covering refractories, clays, and minerals, and 12 papers of a more general nature. Every paper appearing in *The Journal* is reviewed by a Division Editorial Committee and the Editor. The following eight divisions have active Editorial Committees of three men each: Art, Enamel, Glass, Materials and Equipment, Refractories, Structural Clay Products, Terra Cotta, and White Wares.

Ceramic Abstracts contained 298 pages of abstracts segregated in 14 categories, and 71 pages of Index arranged according to author and subject.

Ceramic Abstracts is based upon the work of some 54 abstracters. The Index involves a tremendous amount of detailed work.

The Bulletin for 1935 contains a total of 684 pages; advertisements occupying 243 pages, papers 219 pages, and Activities of the Society 222 pages. There were 47 papers of technical interest, covering refractories, clays, whiteware, glazes, enamels, firing problems, and others.

Compared with 1934, in 1935 a greater number of papers have appeared in both *The Journal* and *The Bulletin*.

Cost Analysis and Survey of Publications

This Committee has been engaged in a preliminary survey of the structure and detailed costs of our publications with the view of building up sufficient data to warrant further recommendations. It is essential to know the cost in labor, materials, and time of every phase of our publications on the part of every member of the staff who contributes to it, so that a true evaluation of the product can be obtained.

Proposed Changes in Constitution Involving Publications

During the year the Committee has been instrumental in bringing before the Trustees several recommendations for the revision of the Constitution involving publications.

A committee, appointed by President J. M. McKinley, consisting of *Chairman* J. T. Littleton, J. C. Hostetter, and Louis Navias made a draft of the proposed changes in October and submitted it to the proper authorities for further action. In the main, the proposed changes deal with the responsibilities and duties of the Committee on Publications and the Editor.

The Committee on Publications wishes to recognize the hard and painstaking work which is necessary to make our Society's publications a success, and here are included the Editorial Office and Staff, the Editor, and the Mack Printing Company.—LOUIS NAVIAS, *Chairman*.

ANNUAL REPORTS OF INDUSTRIAL DIVISIONS

EMERSON P. POSTE, *Chairman of Sections, Divisions, and Student Branches*

ENAMEL DIVISION

Report of the Chairman

Since the combined reports of the various committees present the complete report of the Division's activities, there is little that the Chairman can add in a report of his own.

The question of a summer meeting of the Division has come up for consideration during each of the past two years. Sentiment has been obtained either by a vote of the Division or by letters to Councillors and Committee Chairmen. The consensus of opinion has been that such a meeting is not advisable. Since the Board of Trustees has urged that all Divisions have summer meetings, this matter is likely to be presented to the incoming Chairman. It is, therefore, urged that this problem be considered at the Annual Meeting.

The Enamel Division has grown to be one of the three largest and most active Divisions in the Society. It is, therefore, believed that this Division should have more frequent representation in the highest councils of the Society, and it is urged that efforts be made to secure this representation.

The retiring Chairman is indebted to all committeemen and members for their coöperation during the past year.
—R. M. KING, *Chairman*

Nominating Committee

The following report has been submitted by the Nominating Committee of the Enamel Division:

Chairman: G. H. MCINTYRE: Ferro Enamel Corp., Cleveland, Ohio.
Secretary: B. J. SWEO: National Bureau of Standards, Washington, D. C.
Councillors: R. M. KING: Ohio State Univ., Columbus, Ohio, and H. W. ALEXANDER: Frigidaire Corp., Dayton, Ohio.
Nominating Committee: L. C. ATHY: Briggs Mfg. Co., Detroit, Mich., and H. C. BEASLEY: Baltimore Enamel & Novelty Co., Baltimore, Md.

The members of the Nominating Committee for 1935–1936 are Emerson P. Poste, *Chairman*, Chattanooga, Tenn.; J. D. Tetrick, Baltimore Enamel & Novelty Co., Baltimore, Md.; H. G. Wolfram, Porcelain Enamel & Mfg. Co., Baltimore, Md.

GLASS DIVISION

Report of Secretary

The Glass Division is completing one of the most successful years in its history, in point of the quality of technical papers presented and the interest and solidarity of the membership.

The technical sessions at the Buffalo Meeting were presided over by Chairman James Bailey; and the program, arranged by Vice-Chairman Urban E. Bowes, filled the allotted time with research reports of exceptional merit. These have been mentioned elsewhere in *The Bulletin* and need not all be named again here. G. V. McCauley's report on the engineering features of making the 200-inch disk aroused great interest and attracted visitors from other Divisions. G. E. F. Lundell reported the findings of the collaborating laboratories testing glass for durability by the tentative (powder) method selected by the Committee on Chemical Durability. This Committee was continued, and further data were reported at the Summer Meeting.

Hammondsport, New York, on Lake Keuka, was the scene of another highly successful Summer Meeting early in September. J. T. Littleton again acted as host, and many of the members occupied the cottages at Willow Point. A more formal program than usual was concentrated on the subject of "Strength of Glass." The day's technical sessions, arranged by Vice-Chairman Joe Gregorius with the assistance of Dr. Littleton and Chairman Bowes, brought out an excellent coverage of the subject as it is understood to date. A number of the papers will appear in early issues of the Society's publications.

The Divison voted to coöperate with the British and German Societies of Glass Technology in holding an International Congress in England during the Summer of 1936. John C. Hostetter was appointed our official representative, heading a Committee on Coöperation with the European societies, consisting of H. H. Blau, F. C. Flint, J. S. Gregorius, F. W. Preston, S. R. Scholes, A. Silverman, the President and General Secretary of the Society, and J. T. Littleton.

Another committee, headed by J. T. Littleton, is gathering data and establishing standard methods on testing the strength of glass, collaborating with the A.S.T.M. This group is known as the Glass Section, Sub-Committee V, Committee D-9, A.S.T.M. The other members are Messrs. De Merit, Fox, Hammel, Kennard, Navias, Race, and Spencer. Its field of work is at present limited to glass applied to electrical insulation.

Another activity of the Division has been the translation of papers presented at the German symposium on "Strength of Glass" (under the D.G.G.) last July. Copies will soon be available to those desiring to follow the German reports on this subject. —S. R. SCHOLES, *Secretary*

REFRACTORIES DIVISION

Refractories Division By-Laws

(1) Purposes

The objects of this Division shall be the same as those of the American Ceramic Society with specific reference to refractories.

(2) Membership

The membership shall consist of members of the American Ceramic Society, who have designated their preference in writing to the General Secretary of the Society to be so registered.

(3) Officers

The officers of the Division shall consist of a Chairman, a Vice-Chairman, and a Secretary-Treasurer who shall perform the duties ordinarily pertaining to these offices. The officers together with the retiring Chairman, the Division Trustee, and the Chairman of the Program Committee shall constitute an Executive Committee which shall manage the affairs of the Division. It shall be the duty of the retiring Secretary-Treasurer to write up the minutes of the Division's Business Session of the Annual Meeting and submit them to the new Executive Committee for their approval within ten days after said meeting. After approval by the Executive Committee these minutes shall be published promptly in *The Bulletin of the American Ceramic Society*.

(4) Elections

(a) Division Officers

The officers shall be elected annually by ballot at the last session of the Division held during the Annual Meeting of the Society. Where a member of the Division can not attend the Annual Meeting, he may write out his ballot and mail it to the Secretary-Treasurer. All such ballots will be counted as voted at the Annual Meeting. The newly elected officers shall take office at the close of the Meeting at which they are elected and shall hold office for one year, or until their successors are elected. The Chairman shall not be eligible for immediate reëlection. Any vacancies occurring during the year shall be filled by appointment by the Executive Committee. A person so appointed shall not forfeit the privilege of election to the same office to succeed himself.

(b) Nominating Committee

At the same time at which the officers of the Division are elected, two members of the Division shall be elected in the same manner as the officers, who shall serve both as the Nominating Committee of the Division and as the Division's representatives on the general Nominating Committee of the Society. These two will draw to determine which shall be on Committee No. 1 and which on Committee No. 2. Their names and designations shall be immediately reported to the General Secretary by the Chairman of the Division, or Acting Chairman of the Division. The person drawing No. 1 shall act as Chairman of the Divisional Committee. These two acting as the Divisional Nominating Committee shall report their nominations of the Divisional Officers and Nominating Committee to the Secretary-Treasurer of the Division in time so that he, who is required to do so, can have the nominations announced in *The Bulletin of the American Ceramic Society*, or by letter, at least 90 days before the Annual Meeting. Any five members of the Refractories Division may place an additional name or slate of names in nomination by designating such nominations to the Division Secretary-Treasurer in writing, signed by themselves as seconders, at least 60 days before the start of the Annual Meeting. The actual voting shall be by letter ballot, conducted by the General Secretary of the Society, on being supplied with the names by the Divisional Secretary.

(c) Trustee

Not later than July 15 preceding the Annual Meeting at which the Trustee from the Refractories Division is to be elected, the Division Secretary-Treasurer shall submit nominating ballots to the members of the Division, who shall designate three different names as their preference for this office, and return said ballots to the Division Secretary-Treasurer. In counting these ballots first choice shall count three, second choice two, and third choice one. The name of the person receiving the highest number of counts within thirty (30) days after ballots are sent out shall be certified to the General Secretary of the Society not later than December 31 of each year, as the Trustee representing the Division.

(5) Meetings

The Division shall meet in conjunction with the Annual Meeting of the parent Society and at such other times and places as the Executive Committee acting with the Board of Trustees of the Society shall decide.

(6) Standing Committees

(*a*) The Division Chairman shall appoint chairmen for a Division Program Committee, a Division Membership Committee, a Division Publications Committee, a Division Research Committee, and a Division Rules Committee. These chairmen shall in turn each select two committee members, who shall be subject to approval by the Division Chairman. Any of these committees may be enlarged for the fiscal year, at the discretion of the Executive Committee. The duties of the Publications Committee

shall be to read and edit or reject *all* papers hereafter intended to be presented before the Division, and all other papers on refractories submitted for publication in the *Journal*.

The duties of the Research Committee shall be to familiarize itself with researches which are being conducted on refractories and to determine what additional researches might be expected to yield results that would advance the art. The further duties of this Committee shall be to endeavor to prevent duplication of researches on refractories, to promote coöperation between those who are conducting researches which are of like nature on refractories, and to suggest researches on refractories to those desiring such information. The Chairman of the Research Committee shall be the Divisional Representative on the Research Committee of the parent Society, being the representative provided for under Section (6*b*).

(*b*) The Division Chairman shall appoint a representative of the Refractories Division to serve on each of the following committees of the American Ceramic Society:

Committee on Standards, Group on Standardization of Tests, and Committee on Standards, Group on Standardization of Products: Combined into one Divisional Committee of two members. The member of longest standing on the Committee shall be its Chairman and report to both Committees of the parent Society. If both are of equal standing, the chairmanship shall be determined by drawing lots.

Committee on Research: one representative.

Committee on Data: one representative.

Committee on Ceramic Education: one representative.

Any of these Committees may be dropped and new Committees be added by action of the Executive Committee in accordance with the requirements of the parent Society.

(7) Special Committees

The Chairman of the Division shall appoint such special Committees as the Executive Committee may deem necessary.

(8) Rules on Presentation of Papers

All papers intended for presentation before any meeting of the Refractories Division shall be in the hands of the Division Chairman at least ninety days before the date of the Meeting at which they are to be presented, except by written consent of the Division Chairman.

It shall be the duty of the Division Chairman to have his Publications Committee pass on and edit or reject said papers before they are preprinted. The decisions of the Refractories Division Publications Committee shall be final, except that the right is reserved to the Publications Committee of the parent Society to decide whether or not any given paper shall be published, providing the Chairman of the parent Publications Committee makes such reservations in writing to the Chairman of the Refractories Division at any time before the paper in question goes to press.

So that special programs can be arranged, details concerning the order and time of presentation of papers may be determined by the Executive Committee for any period, prior to the start of that period. If, however, the Executive Committee does not pre-arrange such matters, the procedure shall be as follows:

(*a*) The time allowed for the presentation of any paper before any Meeting of this Division shall be limited to 15 minutes unless otherwise ordered by vote of the members present.

(*b*) The time allowed for the discussion of any paper shall be five minutes per speaker; any person, however, speaking on a paper, may speak again after all others desiring to speak on the paper have been heard. If occasion arises the total time of discussion of any paper may be limited by vote of the members present.

(*c*) Papers consisting primarily of promotional or advertising material shall not be presented. The Chairman of the Program Committee shall approve papers. In case of argument resulting from disapproval, or in case of doubt, final decision shall rest with the Executive Committee.

(*d*) The publication rights of all papers and written discussion presented before the Division shall be vested in the American Ceramic Society unless such rights are specifically released in writing by the Committee on Publications of the parent Society.

(9) Amending By-Laws

These By-Laws may be amended in the same manner as the By-Laws of the parent Society are amended.

(10) Quorum

Ten members of the Division in good standing at any regularly called meeting shall constitute a quorum. A majority shall rule except as otherwise specified in the By-Laws.

Compiled by the Rules Committee of the Division.

—K. E. Buck, *Chairman*

Editorial Committee Report

The following report presents data to March 1, 1936.

Refractories Division papers	Presented Feb. 1934	Feb. 1935	Sept. 1935	New papers	Total
Reviewed once	4	18	3	5	30
Reviewed twice	2	2	0	0	4
Recommended for publication in *Journal*	2	12	0	3	17
Recommended for publication in *The Bulletin*	2	4	3	2	11
Published in *Journal*	2	12	0	2	16
Published in *The Bulletin*	2	4	2	1	9
Published elsewhere	0	0	0	0	0
In hands of Committee	0	0	0	0	0
Rejected	0	1	0	0	1
Returned to authors for revision and not returned to Committee	1	1	1†	0	3
Presented and not received to date	3	2	2	0	7
Awaiting publication	0	0	0	2	2

† Ohio Ceramic Industries Assn. paper.

The Committee wishes to thank the Society's Editorial Staff for their splendid coöperation during the year.

—H. E. White, *Chairman;* R. B. Sosman and R. K. Hursh.

STRUCTURAL CLAY PRODUCTS DIVISION

Report of Chairman

The discussion at the Annual Meeting in 1935 indicated an intense interest on the part of manufacturers of structural clay products in the subject of de-airing. The officers therefore decided to concentrate their efforts during the year on gathering the latest information on this subject and presenting it at the Columbus Meeting in 1936.

Questionnaires were sent out to all firms using de-airing machines by T. W. Garve, Chairman of the Committee on Data. From these, eighty replies were received. Mr. Garve's report will be presented at the Columbus meeting.

The Division Chairman corresponded or had personal interviews with many of the users and manufacturers of de-airing equipment on the subject of the problems confronting them. In a number of instances this resulted in the promise of a paper for the Columbus program.

The Division Chairman has also had considerable correspondence with members of the Division who have not been attending Meetings in recent years, in an effort to rearouse their interest. With the improvement in business conditions, especially in construction lines, a revival of interest now appears certain.

W. C. Rueckel, Chairman of the Program Committee, severed his connection with the Engineering Experiment Station at The Ohio State University soon after the Buffalo Meeting to accept the appointment as Chief of Research with the Koppers Company. His interests therefore changed from structural materials to refractories. In spite of the loss of contacts brought about by the change, Dr. Rueckel carried on and, with the assistance of his Committee, accomplished an excellent job, obtaining a total of more than twenty papers for the Columbus meeting.

Recommendations

The Division Chairman recommends that the newly elected chairman be furnished with a list of members of the Division immediately after the Annual Meeting.

It is also recommended that hereafter the Division elect a vice-chairman who shall assist the chairman in handling the meetings. —A. F. GREAVES-WALKER, *Chairman*

WHITE WARES DIVISION

Research Committee's Advisory Subcommittee on Whiteware to the National Bureau of Standards

The meeting was called to order at the National Bureau of Standards on October 7, 1935. Members present from the industry were F. H. Riddle, *Chairman;* A. V. Bleininger, W. Keith McAfee, E. Schramm, A. H. Fessler, Donald Hagar, and D. P. Forst.

P. H. Bates, Chief of the Division of Clay and Silicate Products, explained briefly the types of work which the Bureau is in a position to undertake and the source of the funds available for the work. The list of problems which had been suggested to the Bureau of Standards in the first meeting of this advisory group in May, 1931,[1] was read and comments were made as to the present status of the work.

A report was given by G. R. Shelton covering the two methods being used in his study of the glass phase formed in heated clay materials. A report of the first phase of this study has been published.[2]

W. W. Meyer summarized the work completed and in progress on china clays in whiteware bodies. Reports of the completed work have been published.[3]

The third report of investigations in progress was made by E. N. Bunting on the system K_2O–PbO–SiO_2. A summary of the data obtained is published in this issue of *The Bulletin*, p. 92. It was agreed by the Committee that the study of the system B_2O_3–PbO–SiO_2 should be considered for future work.

The fourth report was made by R. F. Geller covering the work on talc. Two phases of the investigation have been completed and the reports have been published.[4]

In the general discussion following the presentation of reports by Bureau representatives, two problems were presented for consideration by W. K. McAfee as follows:

(1) Investigation and the development of a test for the determination of the hardness of ceramic surfaces which would enable quantitative determinations reproducible at reasonable expense. Such a study should involve also, for comparison, plastics and other organic competitive materials.

(2) A study of the fundamentals involved in the vacuum treatment of plastic clay bodies.

—R. F. GELLER, *Acting Secretary*

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[1] *Bull. Amer. Ceram. Soc.*, **12** [10] 304-305 (1933).

[2] G. R. Shelton, "The Nature of the Glass Phase in Heated Clay Minerals: I, Common Clays," *Jour. Amer. Ceram. Soc.*, **18** [10] 289 (1935).

[3] (*a*) T. A. Klinefelter, W. W. Meyer, and E. J. Vachuska, "Some Properties of English China Clays," *ibid.*, **16** [6] 269 (1933).

(*b*) T. A. Klinefelter and W. W. Meyer, "Properties of Some American Kaolins and a Comparison with English China Clays," *ibid.*, **18** [6] 163 (1935).

[4] (*a*) R. F. Geller and A. S. Creamer, "Talc in Whiteware Bodies of the Wall-Tile Type," *ibid.*, **18** [9] 259 (1935).

(*b*) R. H. Ewell, E. N. Bunting, and R. F. Geller, "Thermal Decomposition of Talc," *Jour. Research Nat. Bur. Stand.*, **15** [5] 551 (1935); R.P. 848.

ANNUAL REPORTS OF LOCAL SECTIONS

BALTIMORE-WASHINGTON

The officers of this Section are as follows:

Chairman, Royden A. Blunt, Buck Glass Co., Baltimore, Md.
Vice-Chairman, Lester Haner
Secretary-Treasurer, G. H. Spencer-Strong, Porcelain Enamel & Mfg. Co., Baltimore, Md.
Councillor, T. A. Klinefelter, National Bureau of Standards, Washington, D. C.

There are 40 members, 100 associate members, and 57 of these are members of the Society. The dues are one dollar a year. Two meetings were held in 1935, with an average attendance of 35 members and 5 guests. A dinner is held, followed by a business meeting and a talk on ceramics or related subjects. N. W. Taylor's talk on "Chemical Reactions in the Solid State" was a feature of the 1935 meetings.

Three meetings are planned for 1936, with a single speaker, permitting more time for round-table discussions.

—G. H. SPENCER-STRONG, *Secretary*

CHICAGO SECTION

The officers of this Section are as follows:

Chairman, G. G. Hanson, Chicago, Ill.
Vice-Chairman, George Arras, Chicago, Ill.
Secretary-Treasurer, H. V. Kaeppel, *Ceramic Industry*, Chicago, Ill.
Councillor, C. W. Parmelee, University of Illinois, Urbana, Ill.

The dues are $2.00 a year; four meetings are held each year as the Chicago Section and eight meetings with the Chicago District Enamelers Club.

Members of the Chicago Section hold membership in the Enamelers Club and *vice versa*, wherefor this review will include the activities of both groups.

The highlights of the activities for 1935 began with the "Symposium on Insulating Refractories" in January. The annual stag of the Enamelers in May is always a rousing affair and well attended. The Glass Conference at the University of Illinois in June drew an attendance from the Middle West and eastward to the Atlantic seaboard. The Chicago Section members held their annual golf tournament at the Medinah Country Club during the summer. Early in December the Chicago enamelers journeyed to Milwaukee, where they met with the enamelers of southern Wisconsin to hear a paper on "Controlled Oxidation," presented by W. G. Martin, Director of Enamel Research, A. O. Smith Corp.

The program for 1936 includes a joint meeting on April 24 with the Chicago Chapter, American Chemical Society, to hear a talk on "The Physical Characteristics of Refractories," by C. E. Hawke of the Carborundum Co.

We consider it a privilege to coöperate with the officers and members-at-large and to extend the influence of the Society in every way.—H. V. KAEPPEL, *Secretary*

MICHIGAN-NORTHWESTERN OHIO

The officers of this Section for 1936 are as follows:

Chairman, Macon Trabue, Mt. Clemens Pottery Co., Mt. Clemens, Mich.
Vice-Chairman, Tom Place, Mt. Clemens Pottery Co., Mt. Clemens, Mich.
Secretary, Karl Schwartzwalder, A C Spark Plug Co., Flint, Mich.
Councillor, P. W. Dager, Champion Spark Plug Co., Detroit, Mich.

This Section has no dues; therefore there is no definite membership. There is a mailing list of one hundred, and the mailing costs are met by adding a small sum to the price of the dinner held before each meeting. Forty-five of this group are members of the American Ceramic Society.

Four meetings were held in 1935 with an average attendance of twenty-five to forty members and two guests. These meetings are recorded in the current issues of *The Bulletin*. At the present time, there is a discussion for plans of increasing the number of meetings.

—P. W. DAGER, *Councillor*

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PITTSBURGH SECTION

The officers of the Pittsburgh Section for 1936–1937 are as follows:

Chairman, H. B. DuBois, Consolidated Feldspar Corp., East Liverpool, Ohio
Vice-Chairman, Earl C. Petrie, Mellon Institute, Pittsburgh, Pa.
Secretary, Dwight G. Bennett, Mellon Institute, Pittsburgh, Pa.
Treasurer, W. C. Rueckel, Koppers Co., Pittsburgh, Pa.
Councillor, R. E. Birch, Harbison-Walker Refractories Co., Pittsburgh, Pa.

There is an active membership of about one hundred and seventy persons, of whom about one hundred twenty-two are members of the American Ceramic Society. The dues are one dollar a year.

Six meetings were held in 1935 with an average attendance of 40 members and 4 guests.

The meetings are usually general lectures and discussion of ceramic problems, with a dinner meeting once or twice a year.

The meeting of most outstanding importance during the current year had as a discussion topic, "Tunnel Kiln Operating Problems," which was led by D. B. Hendryx, Harbison-Walker Refractories Co.

—Earl C. Petrie, *Secretary*

ST. LOUIS SECTION

The officers for this Section are as follows:

Chairman, J. W. Wright, Alton, Illinois
Vice-Chairman, H. W. Weber, New Brighton, Pa.
Secretary, J. L. Crawford, St. Louis, Mo.
Treasurer, H. W. Perry

There are forty active members in this group; the dues are 50 cents a year. Two meetings were held in 1935 with four guests and an average attendance of twenty-five members. A dinner-meeting is held, and usually four papers are scheduled.—J. W. Wright, *Chairman*

ANNUAL REPORTS OF STUDENT BRANCHES

IOWA STATE COLLEGE

The Iowa State College Student Branch of the American Ceramic Society meets every Thursday at 11 A.M. to hold an informal discussion of the ceramic industry.

The following officers have been elected for the current school year: *President*, Maynard E. McHardy; *Vice-President*, George Haverkamp; *Secretary*, Lee Straight; and *Treasurer*, Sam McHose. Mr. McHose also holds office as Program Chairman.

The plan of the meetings is to give the members practice in speaking before an audience by having them present one-hour talks on subjects of ceramic interest. Mr. McHardy has talked on his experience with the Baltimore Enamel and Novelty Co., where he was employed last summer.

Mark Sweitzer, a student member, was given $20 to perfect a 12-inch vase with a crazed gray-green glaze.

Each year during the Spring Quarter at Iowa State College, the various departments hold open house for the public and prospective students. For this occasion, this department has decided to make a large number of hot-plate tile to be given away to the lady visitors.

The department has been doing a considerable amount of terra cotta work which is being placed in different buildings on the campus.

From present indications, the ceramic department at Iowa State College can look forward to a progressive and prosperous year. For the first time since 1929, the supply of ceramic students is exceeded by the demands of industry. Of all Iowa State College ceramic graduates, only three are not in ceramic work and two of these do not wish to change their present positions.

Within the department itself, at least two important changes are taking place that should make for progress. One is the addition of more than a thousand dollars worth of new equipment and instruments. A new electric resistance furnace of about three cubic feet capacity has been constructed especially for work in overglaze colors, glass painting, and low-temperature glazes and enamels maturing below cone 04. This furnace, which is essentially a sheet-steel box lined with the new lightweight refractories and heated with resistances, was made at a cost of less than forty dollars. Another addition to the existing equipment was the purchase of a Denver Fire Clay Co. standard, gas-fired, P.C.E. furnace which has already been very useful.

Aside from the furnaces, two valuable instruments have been purchased; namely, a new Leeds & Northrup six-point micromax recording pyrometer which has been installed and connected with the department's six kilns, and also a new Leeds & Northrup triple-range optical pyrometer.

The second change that is taking place is a "renaissance" among the students themselves in an effort to convert their regular weekly Student Branch meeting into a lively and powerful organization. This is being done by adopting a new set of by-laws, by using more care in planning meetings, and by more careful selection of committee members. Under this system, work is already getting under way for the annual ceramic open house that will be held in the spring.—Paul E. Cox, *Councillor*

NEW YORK STATE COLLEGE OF CERAMICS

The Student Branch of the American Ceramic Society at the New York State College of Ceramics, Alfred, N. Y., has enjoyed an active year. Monthly meetings have been held, at which time outstanding men in the field of ceramics have addressed the members. Among these have

been Alexander Silverman, Head of the Department of Chemistry, University of Pittsburgh, Ross C. Purdy, General Secretary of the American Ceramic Society, and J. T. Littleton, Chief Physicist, Corning Glass Works, Corning, N.Y. Most of the 225 members of this Student Branch as well as many guests have attended these meetings.

The Annual St. Pat's Celebration will be held March 19 and 20 under the guidance of the Senior class. This affair is the most outstanding function of the year at Alfred University, during which time open house is held at the ceramic college attended by hundreds of persons from neighboring towns. The officers are *President*, Curtis Jackson; *Vice-President*, Stuart Schatz; *Secretary*, Edwin Phillips; *Treasurer*, John Nevins; and *Councillor*, M. E. Holmes.—EDWIN PHILLIPS, *Secretary*

OHIO STATE UNIVERSITY

The Student Branch at Ohio State University has twenty-five active and three associate members. Six of these members carry student memberships in the American Ceramic Society. The dues are $1.50 per year. In 1935 the group held nine meetings with an average attendance of twenty members and ten guests. Ceramic men in various branches of the industry are invited as guest speakers. The students show an active interest in this group, particularly the upperclassmen.

The officers are *President*, John F. Quirk; *Vice-President*, J. Hollin Hyde; *Secretary and Treasurer*, Elmer Long; *Councillor*, Arthur S. Watts.

This Student Branch will act as hosts to the visiting students attending the Annual Meeting in Columbus. On Monday night they will serve a buffet supper at the Deshler-Wallick Hotel, following the reception to the students by the President of the Society.

—JOHN F. QUIRK, *President*

PENNSYLVANIA STATE COLLEGE

The Penn State Student Branch has an active membership of nineteen undergraduate students; associate members include five graduate students and three faculty members. Nine of this group are members of the American Ceramic Society. Officers for the current year are *President*, Richard A. Munro; *Vice-President*, Mervin A. Fay; *Secretary-Treasurer*, David E. Tomkins; and *Advisor*, Nelson W. Taylor.

Five technical meetings have been held this year. The Branch has been particularly fortunate in obtaining speakers authoritative in their respective fields. Among these were Ross C. Purdy, General Secretary of the American Ceramic Society; R. A. Miller, Pittsburgh Plate Glass Co.; E. L. Hettinger, Willson Products Co.; F. O. Anderegg, Consulting Engineer; and Donald Smith, a Penn State ceramic student. In addition to these meetings, Penn State was the host to the Refractories Division for its Summer Meeting.

The meetings have been varied in character. One dinner meeting was held, and a picnic lunch was served in a mountain cabin for the occasion of the Refractories Division Meeting. Speakers have been selected from different fields of work. For the rest of the year a similar plan will be in effect with the addition of one or more social functions.

F. J. Williams on January 1, 1936, resigned as a member of the staff of the Department of Ceramic Engineering to accept a position at the Mellon Institute in Pittsburgh, Pa. Jack Sherman, formerly of the California Institute of Technology, has replaced Dr. Williams at Penn State.

A representation of fifteen men from Penn State is expected to attend the Annual Meeting in Columbus, Ohio.

—R. A. MUNRO, *President*

UNIVERSITY OF NORTH CAROLINA, RALEIGH UNIT

The Student Branch of the American Ceramic Society at the Raleigh Unit of the University of North Carolina has completed one of the most successful years in its history. The present membership is 42, of which 17 are active and 25 associate members. On the average, 85% of the members are in attendance at each meeting. As the College is rather far removed from the center of the ceramic industries, it has been found difficult to obtain outside speakers for the meetings, but this has been made up for by having members of the faculty and those manufacturers who are available speak on their particular subjects.

Some of the speakers and their subjects during the past year have been B. C. Burgess, Manager, Tennessee Mineral Products Corp., Spruce Pine, N. C., "Processing of Western North Carolina Minerals for Ceramic Use"; J. L. Stuckey, Professor of Geology, Raleigh Unit, University of North Carolina, "The State of North Carolina and Its Resources"; A. F. Greaves-Walker, Councillor of the Branch, "The Rhythm and Drift of the Continents"; R. L. Stone, Instructor in Ceramic Engineering, "Art Pottery, Its Design and Manufacture"; H. B. Foster, a former member of the Branch and Technical Field Editor, *Brick and Clay Record*, "Economic Trends in the Ceramic Industries."

The Branch, as has been the custom in previous years, sponsored the department's exhibit in the Annual Engineers' Fair.

This year a large display of pottery made by the students was exhibited. It was acknowledged to be the outstanding feature of the entire Fair. In the laboratory, the method of making the pottery and structural products was demonstrated.

Four of the members put on an exhibit of enameling, making 3- by 5-inch plaques with Tau Beta Pi and Keramos insignia, the College monograms, and silhouettes of the College officials on them to distribute as souvenirs to the visitors.

The associate members of the group made several hundred small-scale models of the College's War Memorial Tower in terra cotta which were also given as souvenirs to visitors.

One member demonstrated the use of the potters' wheel and won the second individual prize for his work.

The departmental exhibit was judged the best of the Fair and was awarded a silver cup, which, although the

Department of Ceramic Engineering is the smallest one competing, is the fourth time in nine years that it has been so honored.

At the November meeting, 23 men were taken into associate membership.

Work is well under way in preparation for this year's Engineers' Fair and the exhibit is most promising.

Five delegates of this Student Branch will attend the Annual Meeting of the Society in Columbus.

The officers for the academic year 1935–36 are *President*, Charles W. Owens, Jr.; *Vice-President*, Robert B. Knox, Jr.; *Secretary*, S. G. Riggs, Jr.; *Treasurer*, John L. McLaughlin; *Representative-at-Large, Engineers' Council*, W. C. Bell; and *Faculty Advisor*, A. F. Greaves-Walker.

—C. W. Owens, Jr., *President*

VIRGINIA POLYTECHNIC INSTITUTE

This student group petitioned and was granted permission by the American Ceramic Society to organize a Student Branch in October, 1935. There are no dues and at the meetings there are informal talks or the presentation of a paper by the students. Five meetings have been held since the Branch was organized, with an average attendance of seven members. A lecture by P. S. Dear on "High-Temperature Insulation" was an outstanding feature of the meetings.

There are nine active members in this group. All of them plan to join the American Ceramic Society as student members although only two are members at this time. All members must appear at least once on the program during the remainder of this school year.

The officers are *President*, R. S. Haff, Jr.; *Secretary*, A. M. Harvey; *Councillor*, J. W. Whittemore.

—R. S. Haff, Jr., *President*

WEST VIRGINIA STATE COLLEGE

Information on the ceramic work in progress at West Virginia State College, Institute, W. Va., has been forwarded by J. C. Evans, Director, Division of Trade and Technical Education.

"This is the second year of our work in ceramics. Our instructor is Lawrence C. Edelin, a graduate of Ohio State University. We began the work with a kiln of our own design and construction, using clay found in this locality. We have just completed the installation of the muffle kiln bought from the Denver Fire Clay Company and have secured the necessary chemicals and supplies for operating an improved course next semester.

L. C. Edelin

J. C. Evans

"Our catalog listing of courses in ceramics shows the following introduction: 'Ceramic courses treat the various methods of making pottery, glass, porcelain, and enameled ware and structural products. They include decorative processes, glazing, and the actual forming, glazing, and firing of pottery.'"

THE KERAMOS CONVOCATION

It is particularly fitting that the convocation should be held in the home of the Ohio State University as it was at this institution that Beta Pi Kappa, the first professional engineering fraternity in the country, was organized in 1902 by a group of students in the original department of Ceramic Engineering. In 1932 Beta Pi Kappa was merged with Keramos, which was organized in 1915 at the University of Illinois.

With the merging of the two fraternities, the alumni of both began to take a greater interest and decided that this organization, being composed entirely of technically trained ceramists, should have, as its principal objective, the advancement of their professional status.

Keramos has chapters at the University of Illinois, Ohio State University, University of North Carolina, and Alfred University, and subchapters at Georgia School of Technology, University of Washington, Missouri School of Mines, and Iowa State College.

The Keramos program includes a business meeting late Wednesday afternoon followed by the annual banquet, at which the national officers for the next biennium will be installed. After the banquet a model initiation will be put on by the officers of the Ohio State Chapter.

The retiring national officers are *President*, F. L. Steinhoff; *Vice-President*, A. H. Fessler; *Secretary*, C. M. Dodd; *Treasurer*, S. R. Scholes; and *Herald and Historian*, A. F. Greaves-Walker.

ART DIVISION SYMPOSIUM ON CERAMIC CRAFT WORK

SMALL KILNS FOR SCHOOL AND STUDIO SERVICE*

EDITOR'S NOTE: These discussions were presented at the First Fall Meeting of the Art Division held in Syracuse, N. Y., October 25 and 26, 1935. A discussion on "Ceramic Art and Education" appeared in the January, 1936, issue of *The Bulletin*. To L. E. Barringer, Chairman of the Art Division, grateful acknowledgment is made for his part in collecting and editing this material.

INTRODUCTION

BY C. H. PARMELEE[1]

Many people have expressed dissatisfaction in both the operation and price of the kilns now in general use. The criticisms and suggestions offered at this meeting should be considered constructively. Many of the kilns in use are of the same type as those used years ago. Industrial furnace builders would not submit to customers the same plans and materials that were in use thirty years ago. The same is true of fuels. Oil as a fuel is probably obsolete in many places and a better fuel could be provided in particular cases.

This whole question should be treated as a problem in working out a tool for use by teachers, pupils, and individual potteries—like the machinist's micrometer, which is perfectly fitted for use, but about which the machinist does not care to know anything other than that it works satisfactorily for his purposes.

SUPER-REFRACTORIES FOR SMALL KILNS

BY B. M. JOHNSON[2]

As manufacturers of super-refractories, particularly those types characterized by high thermal conductivity, we contact many users of muffle kilns. We also supply muffles, tubes, and other refractory shapes for most of the standard designs of small kilns, but our experience with the *operation* of such kilns is rather limited. Recently, however, we had an interesting experience with small kilns in use for art pottery work.

One of our friends built a muffle kiln with kiln loading space dimensions 3 ft. 6 in. wide, 4 ft. 6 in. long, and 3 ft. 6 in. high. The kiln was oil-fired, with a single burner firing beneath the hearth and a Carbofrax muffle supported on Carbofrax brick piers. The kiln was intended for use over a rather wide temperature range and was capable of firing to cone 7 without difficulty.

The results from this installation were entirely satisfactory from every standpoint except that of temperature uniformity. Actual operation over a wide range of final firing temperatures showed an almost constant difference in temperature of approximately two to three cones between the top and the bottom of the kiln, and this difference prevailed even after a number of minor changes in construction, the most important of which was to substitute a fireclay floor laid over the top of the Carbofrax muffle floor to decrease conductance. Despite this change, the temperature difference from the top to bottom still prevailed. In addition to the construction changes, various experiments were conducted in operating practice to eliminate this temperature variation. Manipulations of the burner, variations in damper setting, and lengthening the firing cycle were tried without any appreciable change in the condition. Temperature uniformity throughout any horizontal plane was excellent, but the top of the muffle consistently showed approximately two to three cones lower temperature than that immediately above the muffle floor.

Another kiln was constructed with identical loading space, the only change in design being the provision of sufficient space above the muffle arch to permit firing above the muffle arch as well as beneath the floor. The offtake ports from the firing chamber were located approximately half way up the side walls in the muffle. The general construction of this kiln is shown in Fig. 1.

The purpose of this new construction obviously was to permit overfiring and underfiring, thereby

* Received January 30, 1936.

[1] Onondaga Pottery Co., Syracuse, N. Y.

[2] The Carborundum Co., Perth Amboy, N. J.

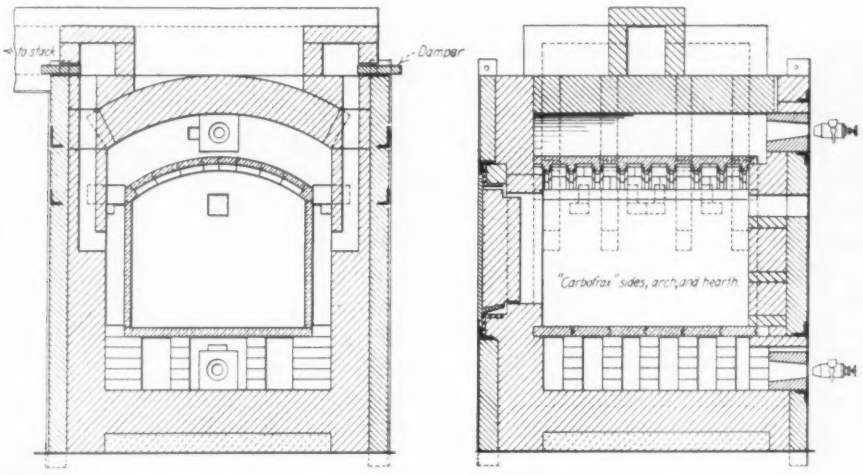

FIG. 1.—General construction of new kiln.

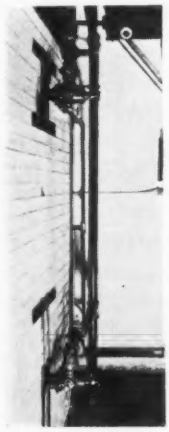

FIG. 2.—Piping and burner arrangement of direct-fired kiln with Carbofrax hearth.

eliminating the temperature differential from the top to the bottom of the kiln.

The results have been satisfactory from every viewpoint. The kiln is easy to handle and very flexible in operation. It is used on firings over a range from cones 016 to 12, and the user believes that cone 16 firings would be entirely feasible.

The following records are typical: (1) Firing to cone 016 with a total fuel consumption of 55 gallons of oil was accomplished with excellent uniformity of temperature in $11^1/_2$ hours; (2) firing to cone 03, 60 gallons of oil, excellent temperature uniformity, $21^1/_2$ hours; and (3) firing to cone 7, 125 gallons of oil, excellent temperature uniformity, $21^1/_2$ hours.

The underfired kiln, mentioned first, showed practically identical fuel consumption on similar firings without, of course, the desired temperature uniformity.

Figure 2 shows the rear of the over- and underfired kiln which is giving uniform temperature from top to bottom, and Fig. 3 shows the interior of this kiln at the completion of a cone 7 firing.

FIG. 3.—Oil-fired muffle kiln showing charge after being fired.

SYRACUSE UNIVERSITY CERAMIC KILN

BY MRS. D. P. RANDALL[3] AND C. H. PARMELEE

This kiln was designed and constructed to fire art pottery to a temperature of 2250°F and to get a uniform distribution of heat throughout the interior of the kiln.

Considerable attention was given in the kiln design to permit easy access to the parts needing repairs from time to time, such as the piers beneath the floor, the floor, the special tile that hold the fire tubes, and the crown tile, without disturbing or tearing out any of the main body of the kiln.

This kiln was also constructed so that the person loading and unloading it would be able to reach all parts of the interior with as little effort as possible. This was accomplished by building the kiln square with a larger door than is commonly used on a kiln of this size. The door, 29 by 31 in., was purchased complete with frame from the Denver Fire Clay Company. The door is of cast iron and of the type that swings out from the kiln and then to one side. Originally it was lined on the inside with about $4^1/_2$ in. of a heavy refractory material, which after two firings

[3] Syracuse University, Syracuse, N. Y.

was replaced by light insulating brick. This cut down the radiation losses through the door and also made the door much lighter and easier to open and close.

Simplicity in operation was also desirable. This was accomplished by installing a burner that does not require any adjustment in the primary air and very little in the secondary air.

The kiln was built to replace a somewhat smaller portable oil-fired kiln which rested on a concrete foundation, 4 ft. 2 in. square by $8^3/_4$ in. high. This foundation was left in and the new kiln was built on it.

Outside of Kiln

The outside of the kiln is of red brick, reinforced at the corners with four 3- by 3- by $^1/_4$-in. angles set 2 in. into the floor and supported at the top by a $^5/_8$-in. rod connecting the four angles. On each of the four sides there are two 3- by 3- by $^1/_2$-in. angles, the lower ones about 2 ft. 4 in. from the floor and the higher ones 5 ft. 8 in. from the floor. At each end, these angles are bolted to the corner ones.

Construction of Base

The first step in constructing the base was to build up a red brick wall tight to the concrete foundation $14^3/_4$ in. high. Inside this wall and on top of the concrete were laid three courses of insulating brick, the first two of a lower temperature brick (Sil-O-Cel C-22) and the top course of B. & W. K-26 insulating brick, a high quality, high-temperature brick.

Burner Blocks and Location

At this elevation the six burner blocks were put in place, three on each side of the kiln and spaced $5^1/_4$ in. apart from center to center. These blocks were specially made from fire clay, 7 in. square and 9 in. long, with a $3^1/_4$-in. round hole running lengthwise into which the burner nozzle extends about $1^1/_2$ in. After the burner blocks were in place, the red brickwork was built up 23 in. high, about $1^1/_4$ in. above the burner blocks, which are $18^1/_4$ in. from the center of the $3^1/_4$-in. hole to the floor.

Flues or Burner Tunnels

After locating the burner blocks, the six flues or burner tunnels were built, three on each side of the kiln, and spaced so that the center lines of the flues were on the center lines of the burner blocks. This allowed a $4^1/_2$-in. wall between the center flue and the two outside flues. These flues, 4 in. high and 6 in. wide, extend to within $2^1/_2$ in. of the center line of the kiln from front to back, which makes them $17^1/_4$ in. from the burner block to the back of the flue. At the end to the center of the kiln, the tops of the flues are open 7 in., making an opening 6 by 7 in. into a combustion space beneath the floor of the kiln.

Combustion Space beneath Floor

The combustion space beneath the floor, into which the flues leading from the burners open, is $38^1/_2$ by $38^1/_2$ in. and 6 in. high, and in this space the piers that carry the weight of the floor, the special tile, and fire tubes are located. There are 20 of these piers, $2^1/_2$ by 7 in. and 6 in. high, spaced 3 in. apart around the outer edge of the combustion space so that they come between the holes in the special tile that carry the fire tubes. There are 6 on each side, 5 in the back, and 4 in the front. In the center there is a pier, $4^1/_2$ by 9 in. and 6 in. high, which supports the center of the floor. This space is lined with B. & W. K-26 brick with a course of fire brick $1^1/_4$ in. thick between them and the red brick which sets the insulating brick in $1^1/_4$ in. toward the center of the kiln. This ledge, which is at the same height as the top of the piers, acts as a support for the special tile which carry the fire tubes and acts as a seal at the joint between the special tile and the lining of the kiln where it is necessary to leave a joint of about $^3/_{16}$ in. to allow for expansion in the floor tile.

Inside of Kiln or Loading Space

The inside of the kiln is $31^3/_4$ in. square inside of the tubes, 31 in. high at the sides, and 36 in. high in the center due to the arch effect of the crown. The loading capacity in cubic feet is about 19.2. The inside lining is of B. & W. K-26 insulating brick with the last course on top, on which the crown rests, of fire brick. The fire tubes rest on the special floor tile and extend up through the crown tile, $1^1/_2$ in. thick, about $^1/_2$ in. into a combustion space, 4 in. high. This 4-in. space is between the crown tile and another crown built above it of standard fire brick, $4^1/_2$ in. thick, and insulated on the top with a $2^1/_2$-in. course of insulating brick.

Dampers

There are two 6- by 8-in. holes in the top crown provided with slide dampers so the area of these outlets can be increased or decreased to get the necessary and proper draft. These two outlets are connected to a smoke box which leads to the stack. The smoke box and the 12-in. pipe which leads to the chimney are of galvanized iron with 1 in. of insulation on the inside.

Burners

The burners are located three on each side of the kiln, supported by the lower angle irons that reinforce the sides of the kiln and are equipped with a sliding shutter that moves on the burner to regulate the amount of secondary air by moving the shutter away from or closer to the burner block where the burner goes into it.

They are the Venturi-type burners using the gas at city main pressure. A mixed gas is used, natural and manufactured (about 75% natural) with a heat value of 884 B.t.u. per cu. ft. The orifices of these burners are drilled to get a maximum fuel input of about 100 cu. ft. per hour per burner. This allows a turn-down ratio of about three to one, making the minimum about 35 cu. ft. per hour per burner. The low turn-down ratio is taken care of during the first few hours of the firing by having 6 burners. When the kiln is started only the two center burners are lighted for the first $1^1/_2$ hours, then the two front ones are put on, and the two back ones are lighted about $3^1/_2$ hours later. This brings the kiln along at the slow rate of temperature increase which is necessary for the product.

Firing the Kiln

The two center burners are lighted and turned as low as possible. The shutters are set $^1/_2$ in. open, having the shutters closed on the other burners. The two slide dampers on the top of the kiln are opened 1 in. This leaves an opening of 6 sq. in. in each outlet or a combined area of 12 sq. in. opening to the stack. One and one-half hours later the front burners are put on, keeping them turned down as low as possible and the shutters set $^1/_2$ inch open. At two hours on fire about 200 cu. ft. of gas is used and the temperature inside the kiln is about 360°F at the top and about 260°F at the bottom. During the first five hours on fire the flue gases are about 330% excess air with the very small CO_2 content of 2.5%, and the temperature at the end of 5 hours is about 700°F throughout the inside of the kiln; approximately 900 cu. ft. of gas is used. At 5 hours on fire the back burners are put on, turned down as low as possible, and the shutters set $^1/_2$ in. open. With all the burners turned down as low as possible, all the shutters open $^1/_2$ in., and the damper 1 in., there is about 150% excess air in the flue gases and 4.5% CO_2. From five hours on fire to eight hours on fire, the fuel input is increased on all of the burners by opening them a very little every $^1/_2$ hour. By leaving the shutters at $^1/_2$ in. open and the damper 1 in. open, thereby not increasing the flow of secondary air in proportion to the increase in the gas, the percentage of excess air in the combustion gases is much less (about 30%) and the CO_2 content is increased to between 8% and 9%. At seven hours on fire, the dampers are opened $1^1/_2$ in., as the fuel control valves are nearly wide open and it is necessary to increase the amount of secondary air to assure complete combustion. At eight hours on fire, the temperature in the kiln is about 1320°F and 2000 cu. ft. of gas is used. All burners are now opened wide and the dampers set 2 in. open. This holds the CO_2 content in the combustion gases to between 9% and 10%, giving about 20% excess air. No other changes are made for the next two hours which brings the firing to the tenth hour on fire. The temperature is 1790°F at the top of the kiln and 1870°F at the bottom. At $10^1/_2$ hours on fire the burners are cut back to about one-half open for about 10 to 15 minutes, allowing the kiln to check and cool down the flues and floor which are making the bottom hotter than the top. After these few minutes of checking, the dampers are opened to 4 inches, the shutters opened wide, and the burners put on full. With this increase in draft, a much larger volume of air is pulled in to the burner tunnels and the combustion space beneath the floor, which tends to keep them from increasing in temperature too fast and tends to carry the heat to the upper portions of the kiln. The kiln being fired this way for an hour or so holds the bottom and brings the top along to finish at the temperature of 1940°F in the bottom and 1890°F at the top. The total amount of fuel used for the firing is 4200 cu. ft. gas.

MATERIAL USED IN KILN BRICK WORK

Fire Brick

137	$2^1/_2$- x $4^1/_2$- x 9-in. straights	12	feather-edge skews
130	2- x $2^1/_2$- x 9-in. straights	23	$2^1/_2$- x 6- x 9-in. flat backs
50	$1^1/_4$- x $4^1/_2$- x 9-in. straights	11	3- x $4^1/_2$- x 9-in. floor brick
65	$4^1/_2$- x 9- x $2^1/_2$–$2^1/_8$-in. slow arch brick	4	11- x 14-in. floor tile; 6- x 8-in. hole

Insulating Brick

450	B. & W. K-26	150	Sil-O-Cel C-22

Special Shapes from The Denver Fire Clay Co.

24	fireclay tubes	6	special crown tile
6	special tile to carry fire tubes	1	door complete with frame
3	4-in. floor tile		

Burners

6 Venturi air mixers from Charles A. Hones, Inc.

Mortars

200	lb. B. & W. air-set mortar	1	yard sand
2	bags Portland cement	2	bags fire clay
1	bag lime		

675 red brick

MATERIAL USED IN KILN IRON WORK

8 bars, 3- x 3- x $^1/_4$-in. angle irons (4 ft. 9 in. long)
4 bars, 3- x 3- x $^1/_4$- in. angle irons (6 ft. 11 in. long)
4 bars, $^5/_8$-in. round iron (5 ft. long)

16 $^3/_8$- x $1^1/_4$-in.
12 $^3/_8$- x $1^1/_2$-in. } machine bolts and nuts
6 $^3/_8$- x 2-in.

2 $^1/_2$- x $2^1/_2$-in. cap screws
12 $^3/_8$ nuts for U-bolts
16 $^5/_8$ nuts for tie rods at top
1 bar, $^3/_{16}$ x $1^1/_4$ flat iron, 11 ft. 9 in. long, for burner brackets
1 bar, $^3/_8$-round iron, 3 ft. 3 in. long, for U-bolts

AN INEXPENSIVE OIL BURNER FOR THE AMATEUR POTTER

BY E. A. SOLOMON[4]

Many people, interested in trying their hand at making pottery, become discouraged when the cost of firing equipment is learned. If their skill at potting is not proved, it appears paradoxical to expend a comparatively large sum for the equipment necessary for the firing process while a relatively small outfit can be used in the actual fabrication. Yet, to leave the pieces unfired or to depend upon other skill is shirking, for the firing of a piece is the real test of its structural merit.

The burner described here was made for use on a ground-hog kiln of about 12 cu. ft. capacity. The kiln was originally built to burn coal, but the neighbors objected to the smoke and the baiting periods interferred with other duties. The kiln is built of used face and fire brick. The stack consists of two home water boilers with the ends removed. These were welded together and set on a brick stack 8 ft. high, giving sufficient draft when the change from coal to fuel oil was made.

As shown in Fig. 1, the blower is mounted directly to the burner, and the entire unit is easily carried. Flexible hose may be used for the oil line if the production requires that one kiln be on fire while the other is being drawn and reloaded. On the burner mentioned, however, $^5/_{16}$-in. copper tubing was used and, while it was not required that the burner be moved any great distance, it proved more practical than pipe and more convenient in connecting it together. Furthermore, such an arrangement is easily taken apart for cleaning.

The oil is fed by gravity and the burner is operated with the oil under a pressure (at the nozzle) of as little as 0.7 lb. per sq. in. For the preliminary trials a quart can was used as a reser-

[4] Hamburg, New York.

voir, placed about 18 in. above the burner.

This burner, complete and in operation, costs, about $5.00. A person ordering one made could have it done in a shop for less than $15.00.

While many refinements can be made, it is thought that any handy man can secure the necessary parts in a junk yard and construct the outfit at small cost. Some improvements will be mentioned later.

The oil nozzle, No. 1, is a piece of steel rod, $^1/_2$ by 1 in., drilled and tapped on one end for standard $^1/_8$-in. pipe. This is screwed on the pipe, which should be about 4 in. long, and a $^1/_8$-in. hole is drilled from the other end. The piece is then turned down to a cone whose sides slope at about 10 degrees. The oil hole should be accurately centered and the edge on the small end of the tip should be fairly sharp. This allows the air to pick the oil more easily from the end of the jet and atomize it.

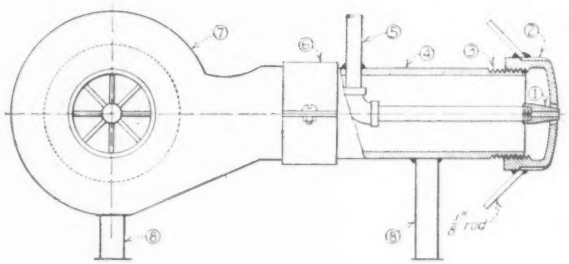

FIG. 1.

The cap, No. 2, is an ordinary 2-in. pipe cap. The closed end will be found to be slightly convex and, therefore, a spot in the center is turned down flat. The hole in the cap has the same slope as the nozzle and is $^9/_{32}$ in. in diameter at the front side of the cap.

The threads that receive the cap, No. 3, are straight threads, not tapered as ordinarily cut to take such a cap.

The burner pipe, No. 4, is 2-in. pipe cut 6 in. long. A $^1/_2$-in. hole is drilled about $1^1/_4$ in. from the end to receive the oil pipe.

The fuel pipe, No. 5, is $^1/_8$-in. iron pipe, using an elbow to make the turn inside the burner.

The band, No. 6, is made from sheet iron and serves to hold the outlet of the blower to the burner. In cases where the outlet of the blower does not happen to be the same size as the burner, a reducing sleeve can be made.

The blower, No. 7, is a used vacuum cleaner blower, that is, the motor and fan and their housings.

There are 3 legs, No. 8; the forward one is welded directly onto the burner pipe; the back two are welded to a strip of $^1/_8$-in. band iron and this is attached to the blower by two bolts which happened to project from the housing.

To assemble the burner, the cap should be screwed on a little more than half way, and the nozzle pipe with the elbow attached is inserted from the other end. The oil jet cone is thus centered in the cap and the end of the jet should protrude about $^1/_{16}$ in. when firmly seated in the cap. The $^1/_8$-in. pipe is then screwed into the elbow through the hole in the side of the burner. The hole should be far enough toward the end so a wrench can be used if it is necessary to remove the elbow. Enough of the oil jet pipe should protrude so that it too may be removed from the front end. With the pieces fitted together thus, the fuel pipe is arc-welded to the side of the 2-in. pipe and the burner is assembled. The oil supply pipe is about 12 in. long. A valve is attached to the end and this in turn is connected to the copper tubing which goes to the supply tank. A handle for carrying the unit was provided by welding a strip to the outside oil pipe and bolting the other end to the top of the fan housing. This also stabilized the connection between the blower and the burner. The legs, as shown, bring the oil jet about 8 in. above the floor, but they may be made any length and are adjustable.

Since the vibration of the motor caused the burner to dance, an iron block was welded to the two back legs. For the same reason the cap tended to revolve and change adjustment. Two $^1/_8$-in. diameter rods were welded on the edge of the cap to serve as handles for adjusting. Two sections of coil spring were fitted to these to prevent the cap from revolving. The cap becomes hot, but little adjustment is required after one becomes familiar with the burner.

When beginning the fire, an oil-soaked rag is placed in the burner port and enough oil is admitted to keep the port barely flooded. The blower is usually turned on full blast although better control of the air volume may be maintained by a light socket put in the cord, and the resistance may be controlled by the size of the bulb (about 150 watts) used in the socket. This would lengthen the life of the blower motor since the blower gives out more air than is required

during the early stages of the firing. For the preliminary heating, the cap is screwed back on the pipe so the oil jet is about flush with the surface of the cap. In about 2 hours the port becomes hot enough to ignite the oil spray and one then screws the cap a little farther out. This increases the velocity of the air and throws the flame farther into the combustion chamber. If this is not hot enough to ignite the oil spray, the kiln will smoke and the flame will again need to be brought out where it can completely burn. Unless the combustion chamber is unusually large, the oil valve is seldom open full. With a head of 48 in., the oil volume is larger than the ordinary combustion chamber can accommodate efficiently without an exceptionally high pressure.

The life of the vacuum-cleaner motor on a job of this sort is a problem; if the used blower is reconditioned, it should last a considerable time. They are inexpensive and broken housings can be patched sufficiently to serve. There will be a difference in the amount of air different types of blowers will put out; the one in use here is small compared with the newer types and there is always a back pressure. To help cool the motor, several small holes were drilled through the housing between the motor and the fan. This outfit has been operated on several different small kilns and once on an enameling furnace and, although the bearings become hot, the winding showed no signs of burning. The total operating time has been seven firings at 12 to 16 hours each. The motor has maple bearings which are not oiled, but in a case where metal bearings are used an oiling system could be easily arranged.

Considering the few crude adjustments provided, the burner is decidedly flexible and works as well as the "professional" jobs for this purpose. No particular precautions are required other than those observed for any oil burner.

Acknowledgment

The author wishes to thank Paul E. Cox, Iowa State College, for his help in conducting tests, and John M. Hughes, Boone, Iowa, for his suggestions.

GAS-FIRED KILNS

DESIGNED BY GEORGE E. VANCE[5]

The small kiln is shown in Figs. 1*A*, 1*B*, and 1*C*; the large kiln, in Figs. 2*A*, 2*B*, and 2*C*. In these kilns, even heat distribution and oxidizing conditions are readily obtained for heats ranging from cones 06 to 13. Ordinary stove burners are used.

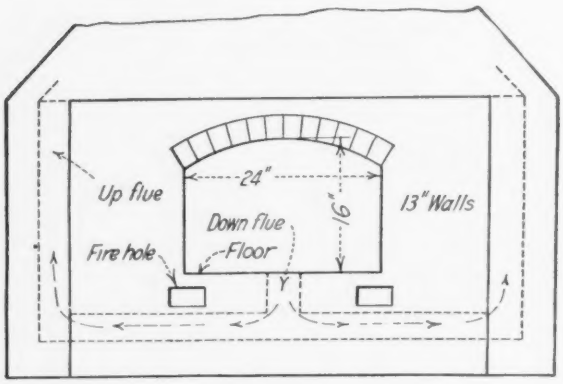

FIG. 1(*a*).

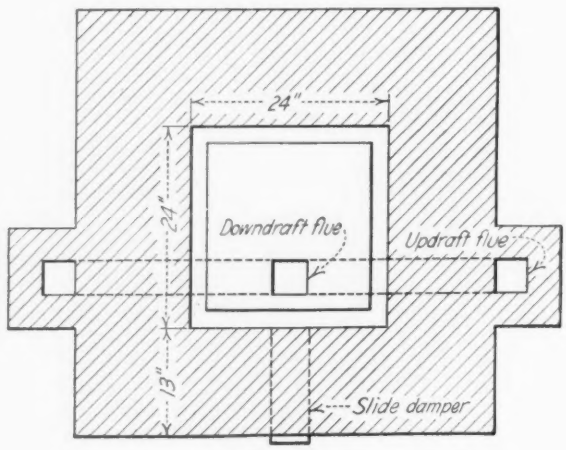

FIG. 1(*b*).

[5] Safety Grinding Wheel Co., Springfield, Ohio.

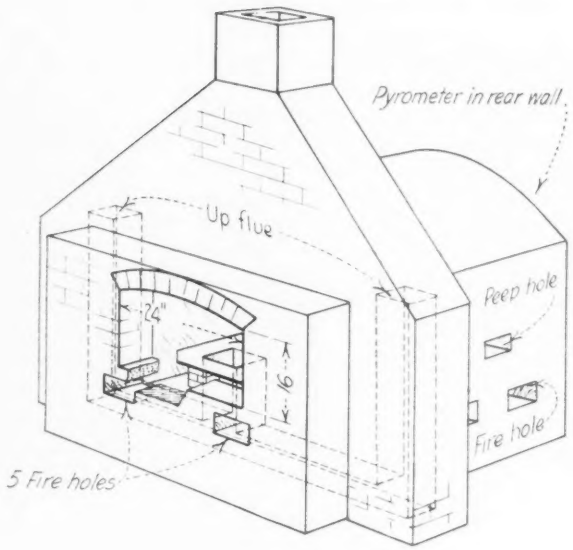

FIG. 1(*c*).

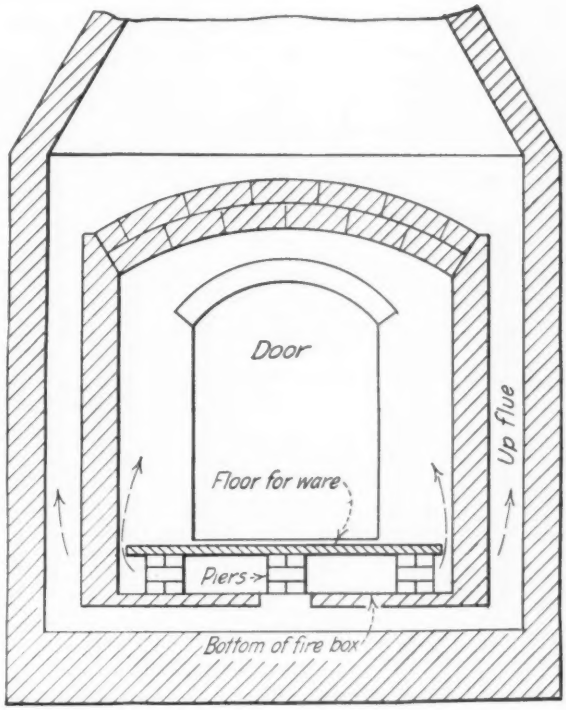

FIG. 2(*b*).

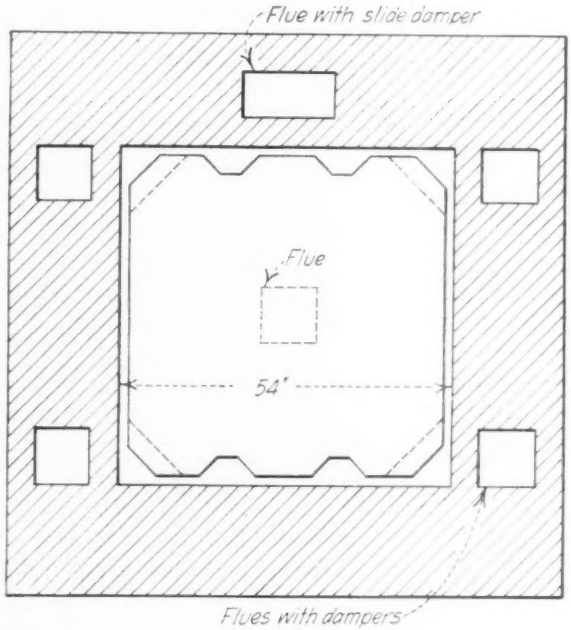

FIG. 2(*a*).

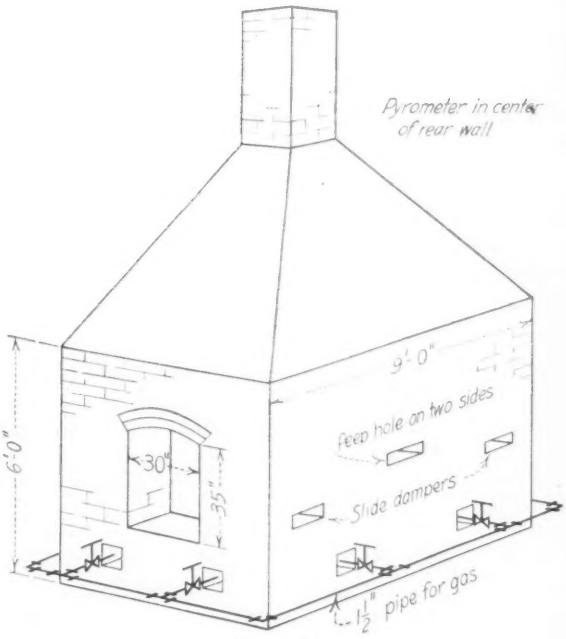

FIG. 2(*c*).

General Discussion

Mrs. Mable C. Brady: Haaren High School, New York, N. Y.

I have had experience with two kilns, a gas-fired kiln built by John Snow, a special kiln builder of Trenton, N. J., and an electric kiln at the Haaren High School. The Hays Electric Furnace Company of Providence, R. I., has worked out a satisfactory electric kiln using Globar resistors. The electric kiln does not give as good a mat glaze as the gas kiln. A small, inexpensive test furnace would be helpful, in addition to an electric kiln and gas

kiln for regular work. The Hays electric kiln has a large ware chamber and an automatic shut-off for temperature control. The job was let on contract and the company bid $2175, although the costs were nearer $3000 before the installation was completed.

F. H. Norton: Massachusetts Institute of Technology, Cambridge, Mass.

The Massachusetts Institute of Technology has made several small test kilns for firing glaze trials. Globar elements, such as are used in bathroom heaters, supply the heat. It has an oxidizing atmosphere, goes to cone 22, and can be heated and cooled quickly.

A small kiln[6] suitable for individual use or for tests was developed in 1933 and has been satisfactorily installed in a good many places.

The cost of materials for this kiln is approximately $100; B. & W. K-30 brick were used, but B. & W. K-26, which are cheaper, may be used. Five or nine burners are used, five for the lower fire. The kiln has a cylindrical structure and is stacked from the top; the muffle construction is of sagger mix and shelves of silicon carbide may be used.

Ralph Manier: Vice-Chairman, Industrial Section, American Gas Association.

Manufacturers of kiln equipment rather than individuals should be relied upon in general to build kilns. The original kiln at Syracuse University used oil, 15 to 20 gallons per firing at 10 cents per gallon to fire 8 cu. ft. of work. A similar kiln, fired with gas, used 3300 cu. ft. of 875 B.t.u. gas or 2.71 therms per cubic foot of volume. The new insulated gas-fired kiln holds 19.2 cu. ft. of work and fires with only 1.74 therms per cubic foot.

Some complaints of improper combustion in the gas burners with consequent loss of heat have been received by various gas companies. The local gas companies or the American Gas Association will work on research problems of this nature if they are consulted.

Luke F. Beckerman: Public High School, Scarsdale, N. Y.

There seems to be no reason for a portable kiln for firing pottery; the portable kiln is only an adaptation of the old china-painting kiln not made specifically for pottery work. There is no reason why kiln linings can not be purchased and blueprints made available so that the kilns may be made by local masons.

Mrs. W. B. Stratton: Pewabic Pottery, Detroit, Mich.

The Pewabic Pottery of Detroit is now making the Revelation kiln. The same old patterns are maintained on the market because many kilns of this type are now in use and must have replacements. A serious attempt is being made to adapt this kiln to better usage. We hope that the users of this kiln will point out the worst features so that corrections and improvements can be made. The lightweight fireclay sample from Harbison-Walker seems to have advantages and I am building a small kiln with it.

R. S. Moore: Harbison-Walker Refractories Co., Pittsburgh, Pa.

The advantages of using a lightweight fireclay brick in kiln construction are quite apparent to those who are concerned with fuel economies and follow the advances in the splendid efficiency of a tunnel kiln. All manufacturers of refractories are interested in obtaining a more satisfactory firing through lower fuel consumption and better insulation. The most recent development in lightweight refractories is suitable for temperatures up to 2200°. This particular refractory can be purchased at a much lower cost than brick which go to higher temperatures but are no more satisfactory for pottery kilns.

R. Guy Cowan: Onondaga Pottery Co., Syracuse, N. Y.

The Art Division owes Mr. Parmelee a debt of gratitude. The problem of experimental kilns for industries is identical with the problem of kilns for the craftsman and because of that we should be able to secure much closer coöperation with the industrial manufacturers. A committee should be appointed to proceed with activities through the year working out the plans which have been developed at this meeting.

Lawrence E. Barringer

I agree with Mr. Cowan that the Art Division is indebted to Mr. Parmelee for organizing and conducting this discussion on small kilns for school and studio service, just as we are indebted to Dean Holmes and Mr. Beckerman for the same service in connection with the other major topics of this meeting.

Discussion of various types of kilns suitable for this non-industrial service can of course be carried on indefinitely. I am anxious to see the matter reduced to a consideration of fundamentals so that teachers and craftsmen will have basic guidance in determining the type of kiln needed for any particular service.

In the consideration of small kilns, as with larger ones, the type of fuel to be employed greatly affects the construction and expense of operating.

In discussing small kilns it might be well to consider such kilns from the viewpoint of fuels commonly available, *i.e.*, coal, coke, oil, gas, and electric current.

Kilns using these various sources of heat might be evaluated along the following lines: (1) necessity of muffle, (2) necessity of stack or chimney, (3) necessity of fuel supply bins or tanks, (4) relative construction cost not including burners or heating elements, (5) quality of kiln atmosphere, (*a*) intensity (temperature), (*b*) evenness (distribution), and (*c*) regulation of oxidation and reduction, (6) accessibility, (7) labor cost of firing, (8) fuel cost of firing, (9) cost of firing per cubic foot of kiln chamber space, and (10) durability.

It will be seen, therefore, that there are many points to consider in connection with the suitability and efficiency of small kilns. First of all, one must determine what conditions are required by the work to be done such as maximum

[6] For a description of this kiln see the paper by F. H. Norton and J. V. Duplin, Jr., "Muffle Kiln of High Efficiency," *Jour. Amer. Ceram. Soc.*, **16** [3] 152–53 (1933)

temperature, conditions of oxidation and reduction, rate of heating and cooling, etc. Insofar as electric kilns are concerned, there is a limitation of the temperatures which can be economically reached and made uniform throughout the interior of even small kilns, but for temperatures within the range of electric kilns, this type provides a clean, nongaseous, and efficient kiln, particularly where installation within such buildings as schools renders some of the other fuels objectionable.

I should like to see such a committee, as recommended by Mr. Parmelee, Mr. Cowan, and others, condense all available information in connection with small kilns and prepare a statement discussing, upon a fundamental basis, the various types of kilns available.

In accordance with the recommendations, I shall endeavor to secure a committee willing to carry on this work until a satisfactory basis of small kiln appraisal has been reached.

CERAMIC CRAFT WORK IN SECONDARY SCHOOLS*

DISCUSSION LEADER: LUKE F. BECKERMAN[7]

There are certain problems which prevent ceramic art work from spreading in secondary schools. The most important of these is that of convincing the school authorities that it is a teachable and valuable subject. When an educator, interested in ceramics, wants to introduce ceramic art work into the school he presents certain questions to be answered. Ceramics is usually considered to be of minor importance in art work. The educator is interested primarily in the immediate benefit the student will derive from ceramic craft work, *i.e.*, how it will become a part of the life situation that the schools are trying to create. How does it integrate with the whole school life? Verbal answers can be given but they do not hold weight with most school authorities. The best way is to start in to teach pottery in a small way and increase as interest grows, as it is certain to grow.

The expense involved in a ceramic course is the biggest problem to the educator. The problem is to convince the superintendent and board that the large expense is justified. The teacher chosen is generally not well enough informed to carry the subject of pottery further than as a minor phase of art work. This lack of information is the biggest drawback both to the teacher and the growth of a pottery course. Usually the teacher is drafted from the art department and takes a short course which is an inadequate preparation to teach the subject. We need teachers who have had training in our art schools, followed by two or three years in a specialized ceramic course. A teacher thus trained and with enthusiasm can begin with little equipment and gradually build up a fairly large department. He can carry over his work in art into the field of ceramics. Word justification does not seem to carry much weight with authorities. The best way is to start a class on a small scale and prove by results that such a course is justified and of value.

In Scarsdale the first graders are made acquainted with clay and the subject is carried throughout the course, finally as an elective in senior high school. Ceramic work is closely correlated with other subjects. The usual type of problem is given: figurines, vases, and often times illustrations for topics in Latin, English, and history. Recently a tile floor and insets above drinking fountains were carried out in clay by the students.

Some of the problems that face those interested in introducing ceramic art work in secondary schools are as follows:

(1) The equipment is too expensive and the price of the kiln is prohibitive. If we could have a design for a kiln to be built by a local mason of materials which could be bought locally or cheaply, a big problem would be solved.

(2) There should be some way of buying materials at less than drug-store prices. Enormous prices are charged for glazes, which are unnecessary when the actual price of the raw materials is known. It is usually necessary to buy the glazes because the schools do not have facilities for making them.

(3) A clearing house is needed where those who are interested in putting ceramics into schools can get in touch with those who are trained in ceramics and available to teach.

(4) There is need for a list or bibliography of ceramic reference material which can be furnished to school libraries and ceramic teachers.

(5) A book is needed on ceramics which is intended for students of high-school age and younger and for the layman. This should be written from

* Received February 26, 1936.
[7] Scarsdale Public Schools, Scarsdale, N. Y.

an appealing point of view and in the simplest terms.

In closing this introduction, the following questions are offered for discussion:

(1) To what extent is ceramic art work in secondary schools justified, particularly to the industrial people?

(2) Should stress be laid on the vocational aspects of ceramic art or should it be taught chiefly from the standpoint of appreciation?

(3) What sort of a vocational situation would the student face if he were encouraged to continue in ceramics?

General Discussion

E. de F. Curtis: Philadelphia Museum and School of Industrial Art, Philadelphia, Pa.

It is a great mistake to encourage a student to go on in ceramics unless he has a very great interest in the subject. Students should not be urged to continue a vocational study of the subject, but they should be encouraged to go into it from the aspect of appreciation.

Mrs. W. B. Stratton: Pewabic Pottery, Detroit, Mich.

Ceramic art has been taught in the high schools of Detroit for years from the point of view of art appreciation and the influence of this teaching was instrumental in the purchase of a Babylonian piece of pottery for the Museum rather than a painting which was considered.

Mabel C. Brady

Allow the children to do what they want to with their hands and appreciation will grow from that. If they can learn appreciation, the teaching of ceramics is justified.

L. F. Beckerman

People must be educated first to know what the problems and benefits are. A headquarters is necessary for dispensing information to people who want to know but have no facts readily available. It may also serve as a place to locate trained people available for teaching.

There is some question about where the subject of ceramics really belongs in the New York Education Department as it is listed in both the Industrial and the Art Departments.

Ruth Canfield: Henry Street Settlement House, New York, N. Y.

The ceramic course at Oswego aims primarily to train teachers of pottery even though it is in connection with the Industrial Art Department. Before the depression an attempt was being made in the State Education Department to create a broad set-up of industrial arts, including textiles, wood working, metal, ceramics, etc. This has never been entirely completed, and there will be more work done on it eventually.

Thomas Ryder: Hershey Industrial School, Hershey, Pa.

At Hershey Industrial School, pottery is required from the seventh grade through the twelfth grade. The seventh- and eighth-grade courses are exploratory, and later those students who are specially adapted carry it on through high school. I do not believe that it should be a required subject above the eighth grade. In high schools it should be an elective. There is too much regimentation.

Mabel C. Brady

At Haaren High School the entire course is elective, except for one term of modeling which is required of senior high school major art students. There is no prerequisite; all high school students take art appreciation, but all other art subjects are elective. Students may work each week five periods of 40 minutes each, but this schedule is adjustable. No less than three periods are allowed, and many students elect five or more periods.

Thomas Ryder

If the subject were elective at Hershey, probably more than one-half the students would elect the subject.

Mabel C. Brady

At Haaren High School it was not necessary to sell the idea of taking pottery and modeling to students after the first few came into the class. The subject sells itself. The idea of architectural terra cotta and tile was stressed at first. In the first term the mechanics of the material, clay, is taught. The student must build a coil jar, straight sides; he must make an unreal animal (a goofus), then an animal on four feet, a standing figure, and a bowl or vase. All approach is individual after the first term. A great deal of design is taught along with the pottery.

Mr. Ryder

At Hershey there is more than adequate equipment, but no satisfactory curriculum has been developed and the course is required. (A description of the unique situation in the Hershey school and town was given.) The course is compulsory through the junior and senior high schools, but I believe that it should be compulsory in junior high school and elective after that time.

My recommendations are (1) that ceramic instruction be compulsory in the seventh and eighth grades, (2) that it be elective in the ninth through the twelfth grades to those who have responded positively to the work in the eighth and ninth grades, (3) that one or two periods a week be allotted the compulsory classes and four periods a week for the elective course, and (4) that the maximum number of students in classes for elective work shall be twenty.

Work has been compulsory in the senior high school upon the basis of teaching it as an appreciation course. If the appreciation point of view is necessary, large expense for equipment is not advisable; this subject can be taught without so much actual manipulation. The subject should be very much specialized to warrant any great investment in equipment.

Clara K. Nelson: N. Y. State College of Ceramics, Alfred, N. Y.

Perhaps Mr. Beckerman will present descriptions of what is being done in other schools to the Hershey administration to help convince them that Mr. Ryder's requests are not unreasonable. A clearing house would be valuable in this case where such information could be made available for distribution.

L. E. Barringer

Mr. Beckerman, Mr. Ryder, and others have clearly indicated that there are certain handicaps in promoting the teaching of ceramic craft work in secondary schools and have pointed out the essential steps to be taken in order to overcome these handicaps.

It seems to me that this interesting and valuable discussion has developed the consensus of opinion that the American Ceramic Society should take the lead in providing the following information for the benefit of those responsible for the introduction and conduct of ceramic craft instruction in the secondary schools of the country:

(1) A convincing statement for presentation to school authorities indicating the justification for ceramic art work in secondary schools, pointing out both the practical and cultural values of such a subject.
(2) A statement showing the extent to which ceramic art work should be carried on with due consideration for modifying the limits in accordance with variation in community types.
(3) A statement indicating the extent and nature of equipment required with a view to providing *adequate equipment at a minimum cost.*
(4) A reference list for teachers and students.
(5) A book on ceramics of inspirational nature.

The needs could be most satisfactorily met by a book devoted to ceramic craft work in secondary schools and the preparation and publication of such a book would be an excellent project for the Fellows of the American Ceramic Society, working in coöperation with the members of the Art Division.

CERAMIC TEXTS AND MATERIALS TO AID SCHOOLS AND CRAFTSMEN

DISCUSSION LEADER: H. R. BACHER[8]

There are, quite surely, nearly a thousand people who are interested in some phase of ceramic art who are not members of the American Ceramic Society. Some do not know of its existence while those who have some acquaintance with its publications find them of little help from the technical or art standpoint. A number of members of the Art Division for some years have wanted to expand the field served by our publications to include subjects of interest to the craftsmen, teachers, collectors, artists, and designers as well as students.

A start was made in this direction at the Annual Meeting of the Society in 1935, and I wish this discussion to carry the idea as much further as possible. If we can offer a publication of real value to the interested people I have mentioned at not too great a cost, we can greatly enlarge our membership and further the interest in ceramic art and craft.

Now that we have separated the *Journal* and *The Bulletin*, the latter, in its new form, seems to be the logical publication with which to start. The following considerations of this subject have occurred to me to be of value.

There are appearing constantly in our publications, articles on fundamental principles by the most able scientific workers in the field, written for other scientific workers. Most artists, craftsmen, and teachers without scientific training find it almost impossible to understand these articles, but the findings and principles are of the greatest use to them in gaining a better understanding of the many processes they must use. To make these valuable articles available, they could be rewritten by competent people in less detail and less highly technical language so that the important principles would be made clear to them.

From these articles of fundamental principles and others of more specific nature, a textbook could be written by a small group working together for the craftsmen, teachers, and others who may not intend making ceramics a life work.

Workable abstracts from foreign publications could be published in sufficient detail that their contents could be applied. While these are now being abstracted and can be obtained in photostat copy of the original, translation of certain articles which would be of general interest would be eagerly read by the people we are considering.

Original articles on equipment and methods by craftsmen, who have devised ways and means of getting their results without expensive commercial equipment, could be presented.

Articles (with cuts) of recent museum acquisi-

[8] White Cloud Farms, Rock Tavern, N. Y.

tions, ceramic exhibitions, outstanding commercial designs, and historical subjects would be valuable.

Materials

In considering materials for the school, craftsman, and teacher, there is little doubt that body materials and their use present the most difficulty. The most severe criticism of the majority of craft and school work in making vessels is that they are porous and of low strength because they are far from vitrification. Attempts to use body fluxes for low maturing body compositions, because of their narrow range, result in excessive deformation in the usual studio or school kiln.

The problem then becomes closely related to suitable kilns. This topic has already been discussed at this meeting. There has been considerable work reported on low temperature bodies, but the results of their use in studio kilns are not available. It seems entirely possible that good bodies can be developed for school and shop use at a low temperature, for their cost can be considerably greater than would be possible in commercial use. This would make a good subject for a thesis in some ceramic engineering school.

Again our "Art Division Bulletin" could be the clearing house for experience with all sorts of ceramic material in the school and shop.

Discussion

Gordon O. Wilber: State Normal School, Oswego, N. Y.

Oswego is training teachers who would begin in a small way to teach ceramic art and would do it satisfactorily if they could find a source of information for supplies and ceramic materials. If the dealers in such supplies as clays, glazes, tools, and equipment would advertise in the two leading industrial arts magazines, *Industrial Education* and *Industrial Arts and Vocational Education* as well as in *The Bulletin* or *Journal*, it would make this information available to such teachers.

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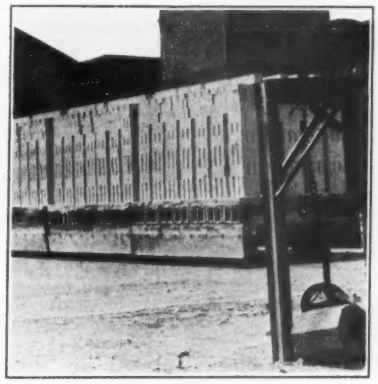

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LOWERED production costs have been a leading factor in the decision of scores of plants to replace other opacifiers with dependably-priced TAM Zirconium Opacifiers. And resultant savings up to 50% have been common. ★ ★ ★ But *quality* of finish is the big "talking point" of TAM Opax and TAM Hy-Opax. These uniform quality opacifiers are definitely giving as excellent a tone, lustre and opacity as the most costly other metallic oxides ever developed. (Frequently TAM Opacifiers far surpass traditional products.) ★ ★ ★ Application of TAM Opax and TAM Hy-Opax offers no difficulty—the former frequently, and the latter always replacing pound for pound any other opacifier, and in color work permitting a reduction in amount of color oxide. ★ ★ ★ Let a TAM Engineer explain fully the quality, economy and adaptability of TAM Opacifiers (for enamels and glazes) and the other TAM Ceramic Materials to your plant. The TAM Engineer who calls on you is backed up by years of ceramic experience, and the facilities of the TAM Research Laboratories. Write:

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GENERAL HEADQUARTERS

1936

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COLUMBUS, OHIO, MARCH 29-30, APRIL 1-2-3

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THE refractories in the kiln and the refractories on the cars must perform under vastly different conditions.

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The cars are in and out—in and out. The refractories are heated up and down—over and over. Long life under these trying conditions demands Crystolon Batts and Saggars—they stand the gaff and hold the loads.

It will pay you to let Norton engineers help solve your refractory problems. They'll be glad to study your conditions and specify the Norton Refractory with the required physical and chemical properties.

NORTON REFRACTORIES

NORTON COMPANY
Worcester, Mass.
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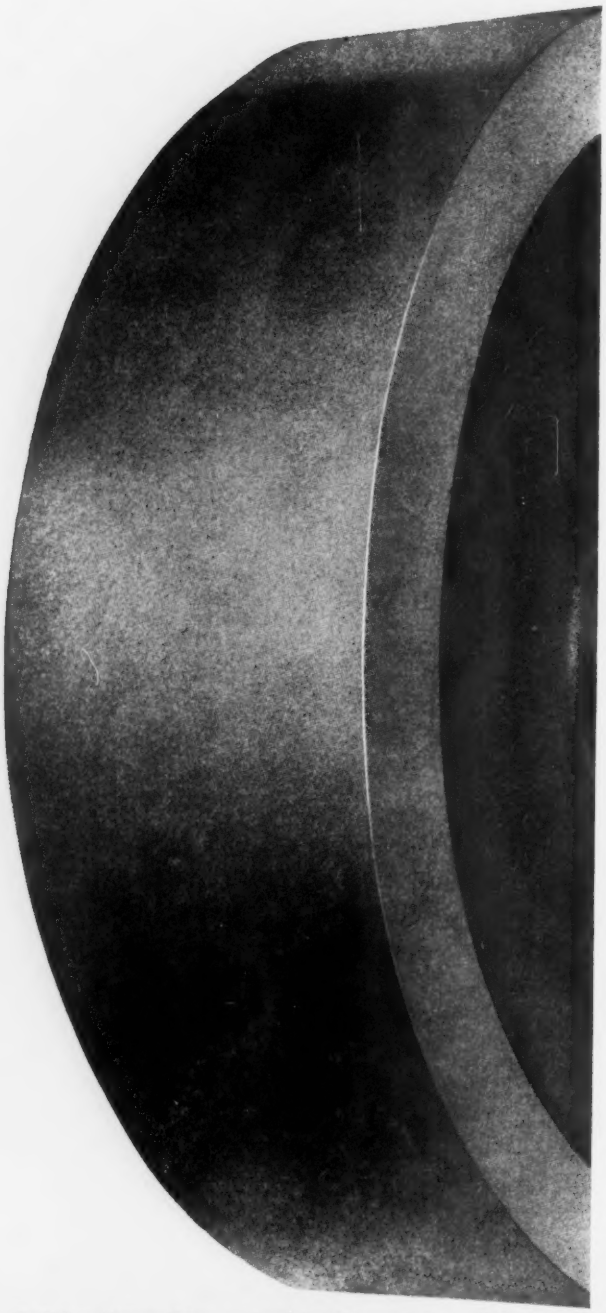
R-527

NORTON PRODUCTS—Grinding Machines; Lapping Machines • Grinding Wheels; Abrasives for Polishing; India Oilstones, Pulpstones • Laboratory Ware, Refractories; Porous Plates • Non-slip Tiles and Aggregates

When it is *STEEL* against *ROCK*



88-80

comes into its own

Bethlehem 88-80 brings a formidable combination of properties to bear on the task of grinding abrasive materials. Developed just for this kind of work, 88-80 has exceedingly high resistance to abrasion, of course. But 88-80 castings have other characteristics too, of equal importance. Their high wear-resisting properties extend all the way through—there's no relatively soft center to grind away rapidly after the surface is gone. And they wear evenly across the face. No overhard corners to cause concave wearing and broken edges.

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1. More material is ground per pound of steel bought.
2. The laborious job of replacing tires occurs less frequently.
3. As the surfaces do not wear concave if properly handled, a higher output per mill can be maintained.
4. The freedom from concave wearing makes for maximum economy of power consumption throughout the life of the tires.

Other Bethlehem Products for the Brick Industry

Bethlehem Abrasive-Resisting Plates—Experience has indicated that these steel plates have from three to five times the life of ordinary plates in chutes, hoppers, dump-car bottoms and similar applications in the handling of abrasive materials.

Bethlehem Tool Steel—Dry press and repress liners made of Bethlehem Tool Steel have exceptionally long life.

Beth-Cu-Loy Sheets—For long-lasting roofing and siding use Galvanized Sheets of low-cost, rust-defying Beth-Cu-Loy (copper-bearing steel). Use Beth-Cu-Loy Black Sheets for pallets.

Also—Bethlehem Light Rails, Steel Ties, and Track Equipment; Steel Bars and Kiln Bands; Boiler Tubes.

Bethlehem District Offices are located at Albany, Atlanta, Baltimore, Boston, Bridgeport, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Honolulu, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, New York, Philadelphia, Pittsburgh, Portland, Ore., Salt Lake City, San Antonio, San Francisco, St. Louis, St. Paul, Seattle, Syracuse, Washington, Wilkes-Barre, York. *Export Distributor:* Bethlehem Steel Export Corporation, New York.

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● *A typical scene in the stock room gives some idea of the multitude of shapes, sizes and the wide scope of the super-refractory products manufactured at the Perth Amboy plant of The Carborundum Company.*

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THE CARBORUNDUM COMPANY has the world's largest production of such refractories.

THE CARBORUNDUM COMPANY enjoys the distinction of having the only plant with research and manufacturing facilities for producing a full, complete line of super-refractory products in all standard or special shapes.

THE CARBORUNDUM COMPANY offers to industry a comprehensive research and engineering service that has had a great deal to do with the development of super-refractories and in solving refractory problems in all high temperature fields.

THE CARBORUNDUM COMPANY invites your inquiries and assures you of complete cooperation.

THE CARBORUNDUM COMPANY

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DISTRICT SALES BRANCHES: Boston; Chicago, Cleveland, Detroit, Philadelphia, Pittsburgh. AGENTS; L. F. McConnell, Birmingham, Ala.; Christy Firebrick Company, St. Louis; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Co., Los Angeles, San Francisco, Seattle; Denver Fireclay Co., El Paso, Texas

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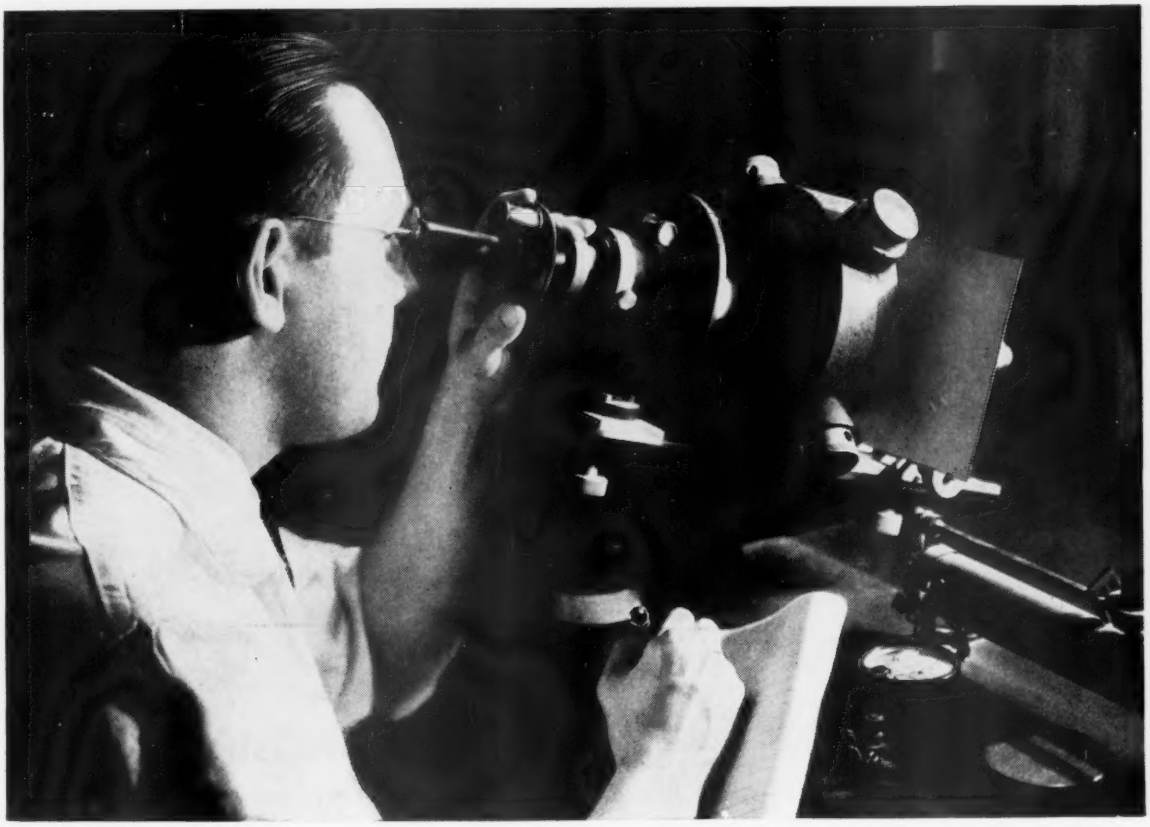

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Laboratory control is not new with Pemco. Pemco porcelain enamels were born in a laboratory twenty-six years ago. Scientific research, including chemical, physical and control laboratories, has always been one of the major influences in creating increasingly finer products.

Above is an observer in the Pemco Physical Laboratory taking readings for opacity on a Priest-Lange Reflectometer. Pemco porcelain enamels are constantly checked with this instrument to guarantee uniformity of color and the greatest opacity. The most modern methods and exhaustive procedure are your assurance of the finest porcelain enamel frits possible to produce.

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Physical control conducted by a trained ceramist in a well-equipped laboratory.

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No Pottery Feldspar leaves the plant that has not first been checked as to fusibility, color and fineness against a standard sample and sample of the previous car shipped the customer.

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Barium Chromate
Bone Ash
Cadmium Carbonate
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Calcspar
Chrome Oxide, Green
Clay, Vallendar
Cobalt Oxide, Black
Cobalt Sulphate
Copper Oxides
Iron Chromate
Iron Oxides
Kryolith
Lead Chromate
Magnesium Carbonate
Manganese Dioxide
Nickel Oxide, Black
Nickel Oxide, Gray
Nickel Sulphate
Potassium Bichromate
Potassium Nitrate
Potassium Permanganate
Powder Blue
Rutile, Powdered
Selenium
Sodium Aluminate
Sodium Antimonate
Sodium Bichromate
Sodium Silicate
Sodium Silico Fluoride
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CERAMIC COLOR *and* CHEMICAL MFG. COMPANY
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Started by

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to standardize and control

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under most

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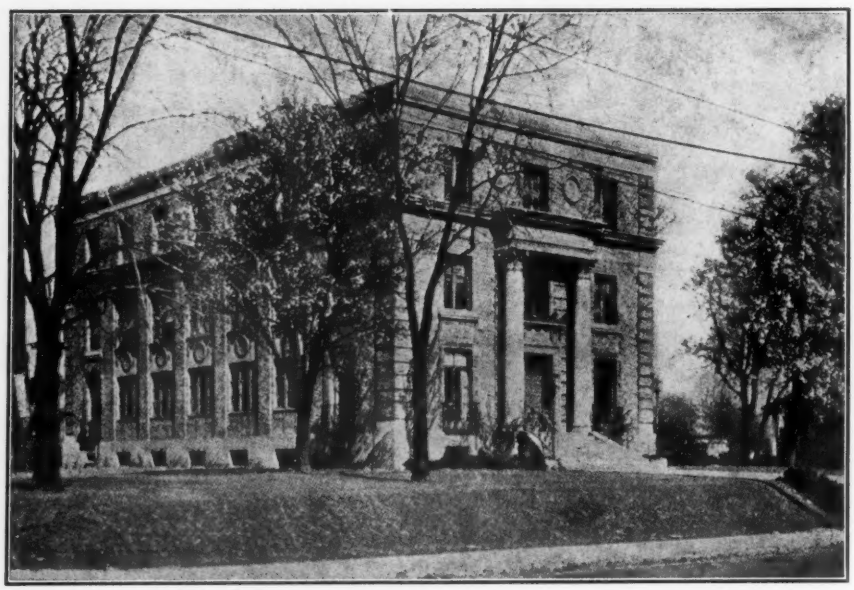
The Edward Orton, Jr., Ceramic Research Foundation Laboratories are housed in the building shown herewith.

Here also the Orton Standard Pyrometric Cones are made.



A GOOD BATCH MIXER DOES THIS . . .

The "Lancaster" Mixer in full mixing action. Note the strongly vibrating life of the batch occasioned by its ever-changing activity—turning, dividing and dispersing the particles without "free fall."

. . . . disperses all batch ingredients perfectly.

. . . . operates efficiently, cleanly, and speedily.

. . . . economizes in use of binders.

. . . . economizes in use of power.

. . . . economizes in maintenance expense.

. . . . lowers operating costs.

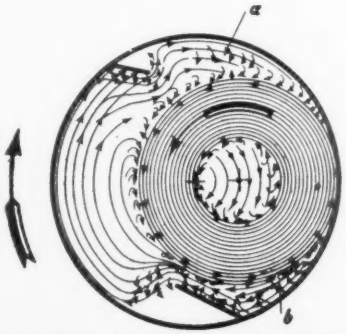
. . . . improves the product.

. . . . provides complete dust control.

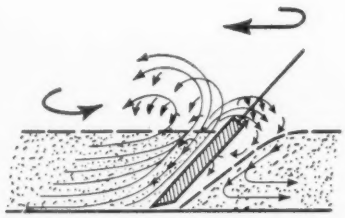
"Lancaster" Mixers Do All These Things...

And More!

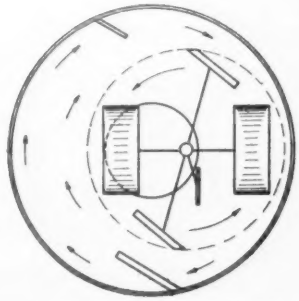
Write for Bulletin 70-B and get the complete picture



Illustrating the intensive "Lancaster" mixing action occasioned by the pre-determined paths material must follow—a counter current whirlpool supported by the oncoming material.



Marginal plows lift and turn the material in waves, forcing the bottom layers to the top.



Illustrating the position of the mullers and plows in relation to the travel of material in the pan.

It's Time We Got Acquainted

LANCASTER IRON WORKS, Inc., LANCASTER, PENNA.

BRICK MACHINERY AND MIXER DEPARTMENT JAS. P. MARTIN, MANAGER

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American Refractories Institute Type

All that you ask for . . .

This furnace is meeting the demands of your industry for a *portable*, *efficient*, *economical* P.C.E. furnace. In addition, it is dependable and easy to operate.

*—Reaches Cone 34 on natural gas; Cone 39 with the introduction of oxygen. The A.S.T.M. rate of heating is easily maintained.

*—Requires but 55 cu. ft. of propane gas per run; or but 153 cu. ft. 1000 B.t.u. natural gas.

*—Sturdy, extremely well insulated and lined.

Bulletin 460

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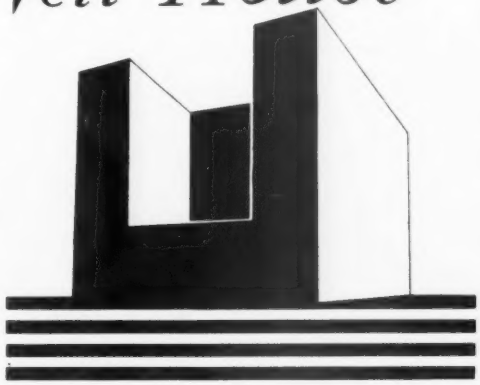

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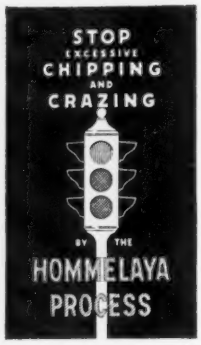

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It's UNIFORMITY.
It comes from ceaseless vigilance—from control that covers every step in manufacturing.
For example—every bit of raw material used in the Frit Department is checked before use. As each lot of frit is smelted, a sample goes immediately to the laboratory. It is ground with the proper mill additions (on special orders, with mill additions from the customer's plant). A trial is fired; checked against all requirements as to opacity, finish, color, and so on—and then, if satisfactory, released.
Uniformity in the finish demands uniformity in the start . . . . and Hommel's ability to assure this is winning new friends each day. Why not see for yourself what Hommel uniformity can do for you?

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